THE JOURNAL OF GAS LIGHTING
WATER SUPPLY & SANITARY IMPROVEMENT

VOL. LXIX. No. 1779.] LONDON, JUNE 15, 1897. [49TH YEAR. PRICE 6d.

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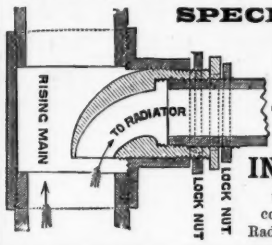

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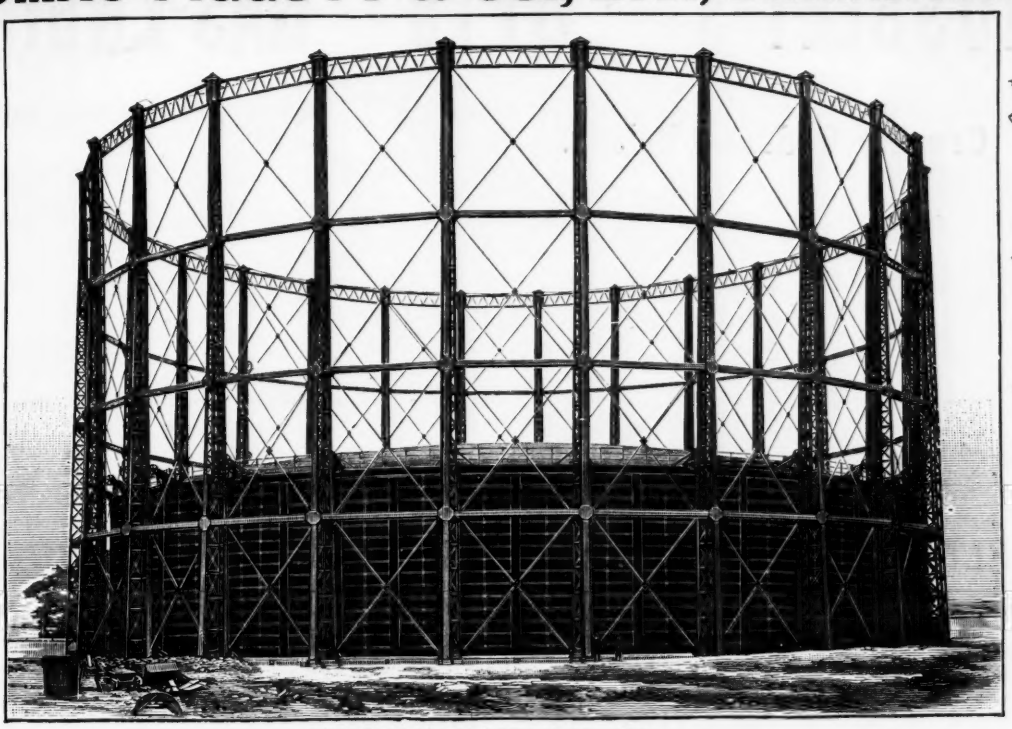

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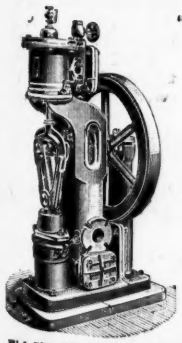

Fig. 705. "SINGLE RAM" STEAM-PUMP.

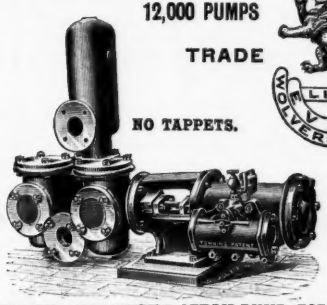

Fig. 598. "CORNISH" STEAM-PUMP FOR BOILER FEEDING, &c.

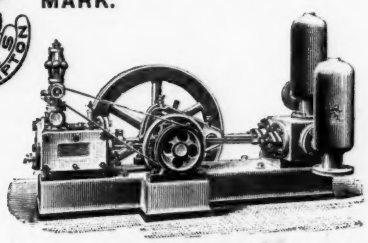

Fig. 683. "RELIABLE" STEAM-PUMP FOR TAR AND THICK FLUIDS.

Fig. 712. "DOUBLE-RAM" STEAM-PUMP.

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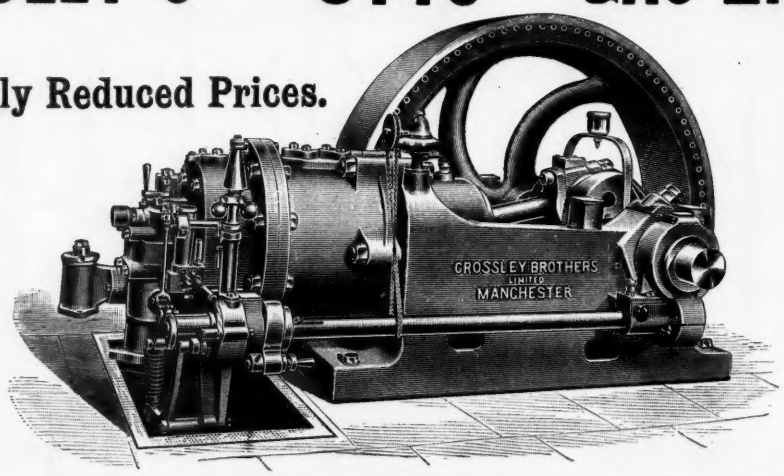

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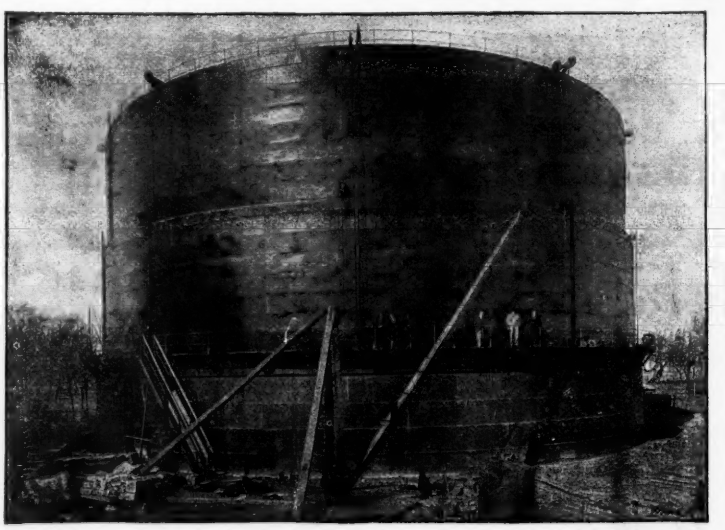

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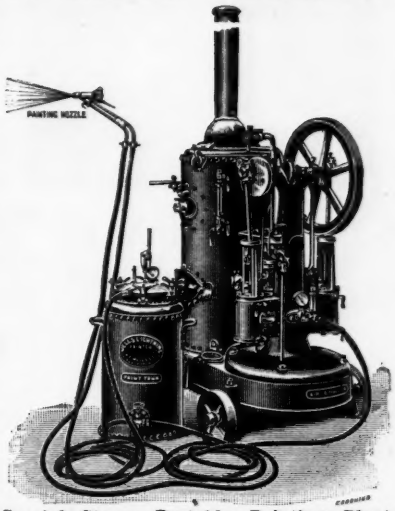

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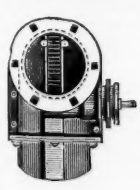

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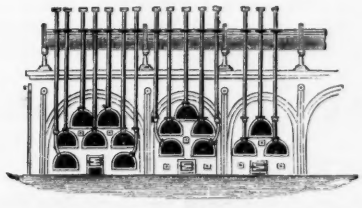

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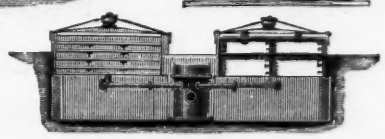

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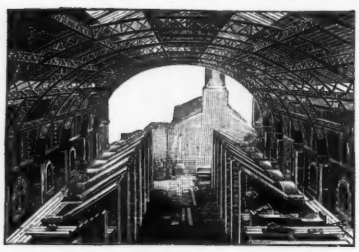

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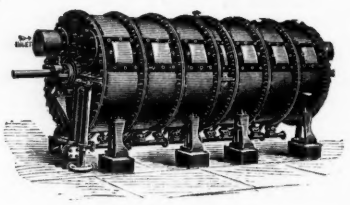

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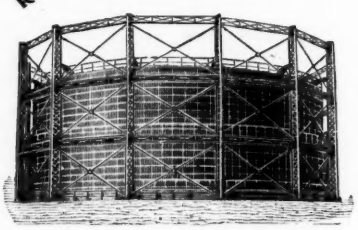

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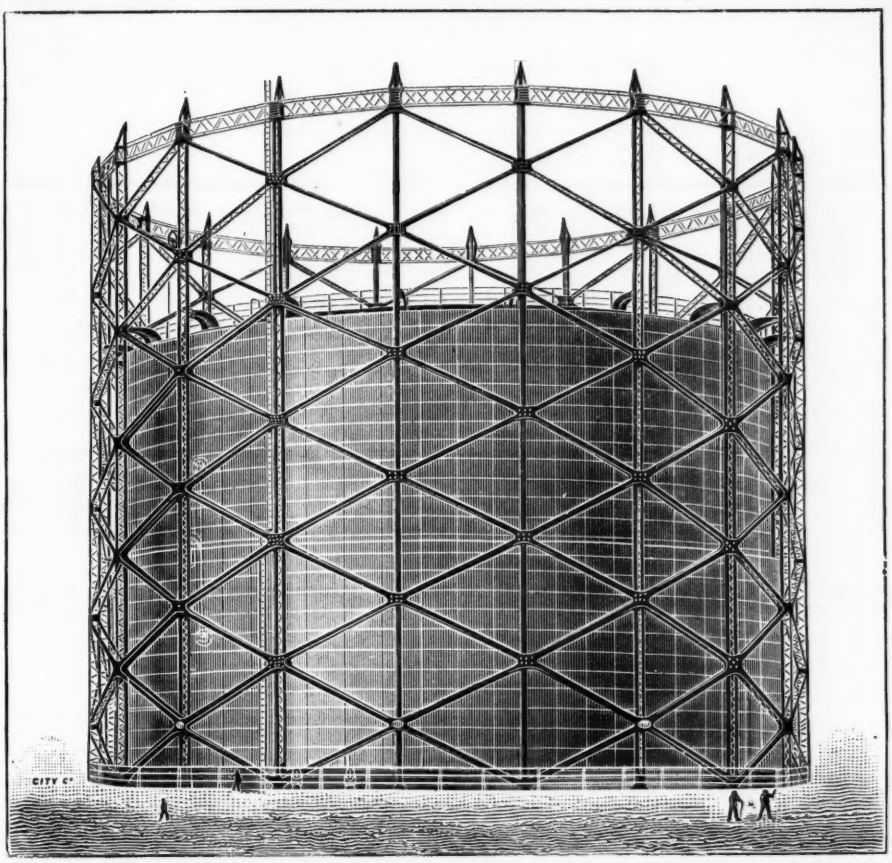

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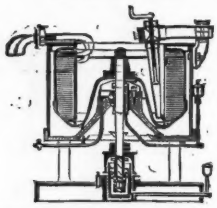

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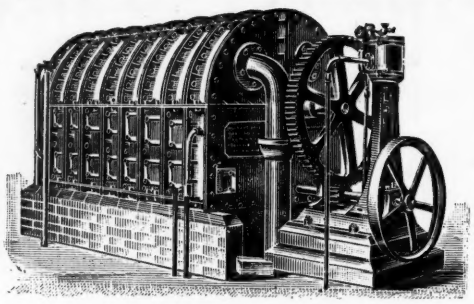

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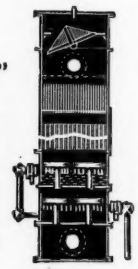

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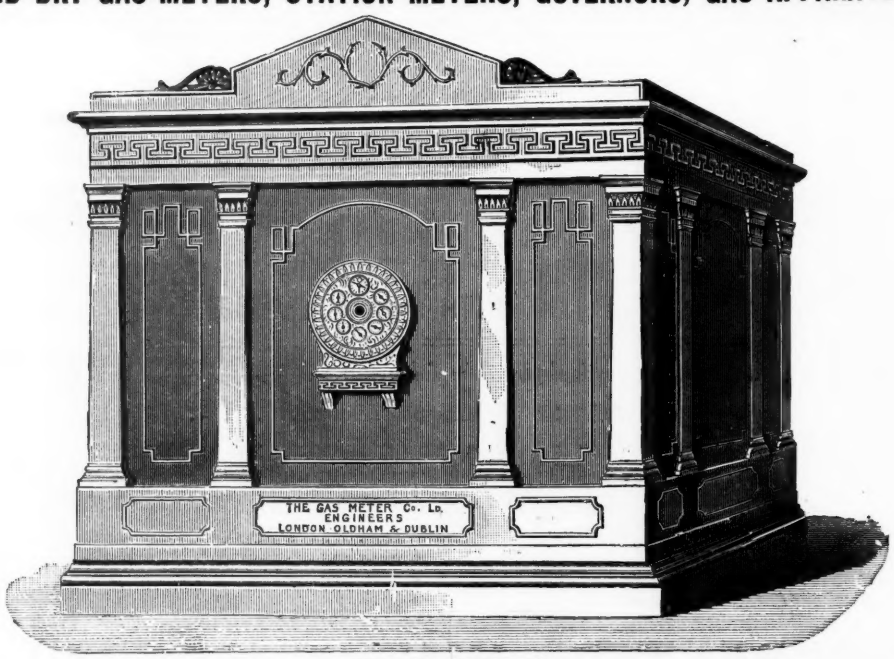

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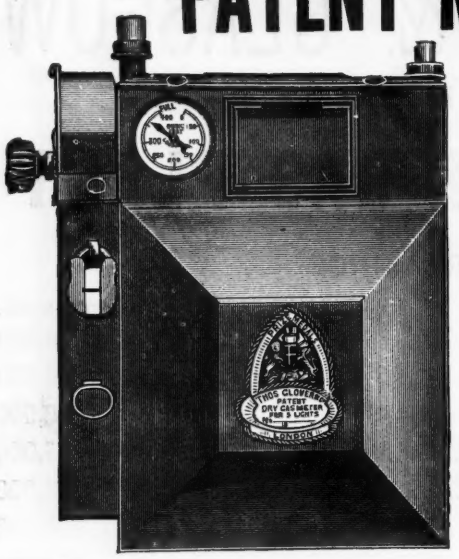

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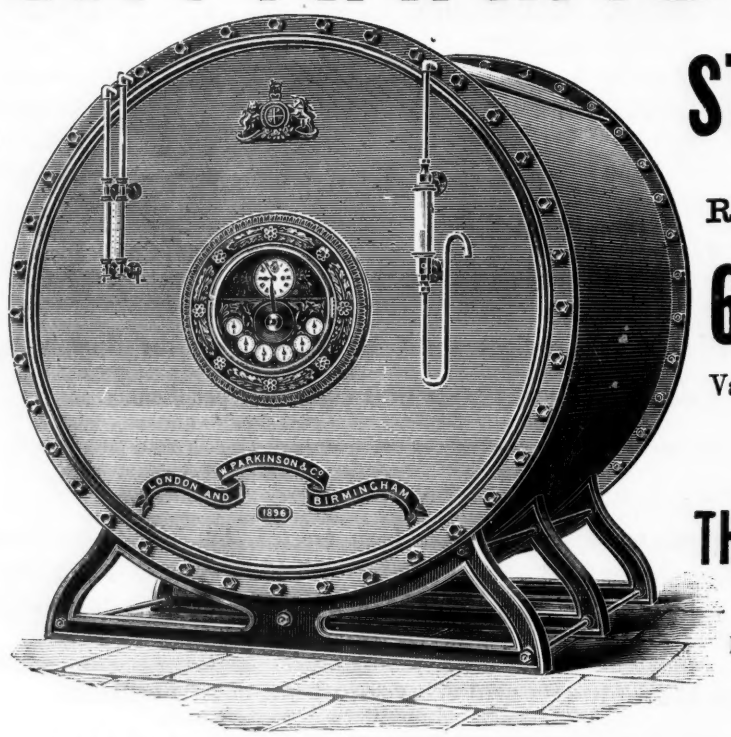

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TO CORRESPONDENTS.

Owing to the JUBILEE HOLIDAY, communications for the next issue of the "JOURNAL" should reach the Office not later than the first post on SATURDAY.

EDITORIAL NOTES.

Two Lessons in Labour Politics.

THERE is no more difficult class of subjects to understand than those which enter into the category of Labour Questions. These questions were perplexing enough when they cropped up naturally from the ordinary relations existing between employers and employed; but since Socialism and other theories concerning capital and labour have been mixed up with the realities of work and wages, confusion has become worse confounded. An illustration of the puzzling twist that these later developments have imparted to the familiar question of the market value of labour, is supplied by a report published by a technical contemporary respecting the behaviour of the London carpenters employed on the Jubilee street scaffoldings. It appears that for weeks past the carpenters have been masters of the situation; and the wages of really capable workmen in this line have consequently gone up to a fancy figure. The other day, the carpenters employed on a particular stand thought they ought to have another 2d. an hour; and on their request to this effect being denied, they promptly packed up their tools and adjourned to the nearest house of call to consider the situation. It was a strike, but not of long duration. The employer could not allow a question of 2d. an hour to stand in the way of the completion of his contract; and he therefore yielded the point before the afternoon was over, or before even the strikers had finished their refreshment. A day or two after this, the executive of the chief organization of the carpenters' trade issued a proclamation stating that they could not countenance strikes for higher wages in the Metropolitan district, because such movements were against the principle of the last formal "settlement" in the building trades! Our contemporary applauded this statement as a sign of grace on the part of the Union, which thus displayed its superiority to market considerations when the latter were in conflict with the sanctity of agreements. This is, of course, one way of looking at the facts; but these are at least open to another construction. It is easy for Trade Union officials to affect a lofty disregard of the labour market when, as a matter of fact, the men can have whatever they choose to ask for, in reason; and it is cheap magnanimity to discountenance strikes when nobody in his senses dreams of striking for any longer period than a summer afternoon. The truth of the case is that, agreement or no agreement, the rate of wages for carpenters in London at this particular season has risen, temporarily, by at least 50 per cent. And very naturally and properly so. The officials of the Carpenters' Union may protest as loudly as they please against the principle of striking for another 2d. an hour; but they would not be such fools as to refuse it, or to flatter themselves that Jubilee pay is likely to be maintained after the emergency is over. It is rather to be desired than hopep that this very lesson of the Jubilee carpenters' harvest may show mechanics of all descriptions how little Trade Union principles and agreements have to do with fixing the rates of wages.

Another lesson, of a different kind, is supplied by the reported collapse of the co-operative glass-works at Carmaux. All the world has heard of the Socialist glass workers of Carmaux, and how they revolted against the industrial tyranny of the Individualist employer. There were sanguinary riots over the question of who was to be master of the original works; and eventually the rebels were started in the business on their own account, with a capital of £20,000 presented by a sympathetic Government and public. "There was to be no capitalist, no master, "but only workmen-directors elected from time to time "by their comrades." The family thus created has not turned out at all a happy one. "On Wednesday last week, "forty workmen left the co-operative works, and asked "the tyrant Resseguier to take them back. They say "that several months' wages are due to them. The "whole capital of £20,000 is eaten up, and the works "are not yet finished. The Society is heavily in debt. "Misery is appalling, and the workmen's wives are "begging in the streets. In a proclamation to their "comrades, in which these assertions are made, the forty "penitent Socialists say that the workmen-directors are "responsible for this situation, and also that fraternity

"does not prevail among the workmen." Having lost their illusions, these sufferers say they feel bound to bring the facts under the notice of the working classes. All this does not prove that co-operative production is impossible, or that workmen-directors are impracticable; but merely that a trick of socialistic oratory does not make its possessor a good man of business. It is precisely the same with the self-styled Labour leaders. The London County Council's knack of cultivating working men's clubs does not necessarily qualify a man for managing a Works Department. Here again is confusion of essentials, such as may well nullify judgment.

Are Gas Undertakers Empowered to Lay Oil-Pipe Lines?

A CURIOUS bit of litigation is threatened from Winchester, where the long-standing feud between the Corporation and the Gas Company over the public lighting has only recently been composed by the aid of the incandescent gas-burner. The present matter, which has been mentioned several times in our news columns, arose out of the action of the Gas Company in laying a pipe through the streets for the purpose of supplying the works with the oil required for their carburetted water-gas plant. The Company wanted to get the oil into their works from the railway goods yard, there being no railway connection; and they considered—very reasonably, as most of our professional readers will probably agree—that the best way of effecting this would be by pumping it through a pipe-line. It is difficult to see in such a proposal anything besides a desire for economy, safety, and saving the public the annoyance of carting oil through the streets. However, the Corporation saw differently; and when they learnt that the main which the Company had laid down, in accordance with their statutory powers, was intended for the conveyance of oil and not gas, they were up in arms about it. The Corporation affected to see in this proceeding an unwarrantable straining of the statutory powers under which the Company have the right of breaking up the streets for the purposes of their undertaking; and they suggested that the Company should compose these scruples by the payment of a quit-rent for the use of the subsoil. To this proposal the Company demurred; holding that the laying of the oil-pipe line came under the general statutory sanction given to all "acts which the undertakers shall from "time to time deem necessary for supplying gas."

Obviously, it would never do to accept the proposition that the oil-pipe was only in the streets on sufferance. The Corporation, unfortunately, seem to be actuated by a litigious spirit. They obtained Counsel's opinion on the matter, which we reported in our issue for the 11th ult. This opinion, we do not hesitate to remark, is a singularly weak one, albeit it was the best the eminent consultant—Mr. A. Macmorran, Q.C.—could do to satisfy the views of his clients. He begins by observing that the powers conferred on the Company by section 6 of the Gas-Works Clauses Act, 1847, appear to him to apply to gas-pipes only. He says: "The section does not give a general "power to lay pipes for any purpose." Nobody has claimed that it does. Doubtless the clause would not cover the laying by a gas company of a main for the supply or distribution for profit of hydraulic or pneumatic power. It does not follow, however, that it would not cover the laying of a pipe to convey anything needed for the internal working of the undertaking—say, from one station to another; or, as in the present instance, from the railway station to the gas-works. Mr. Macmorran is compelled to admit that he does not know of any penalties that could be recovered in the circumstances; yet, in face of this very mild indictment of the Company, the Winchester Corporation have decided to take action against them. They must have more money than they know what to do with, and less common sense than their requirements demand, to commit the City to such a purely vexatious piece of litigation. It is such misdirected expenditure of public money as this that keeps half the English Bar going. What can the City possibly gain if the Company are found to have acted *ultra vires* in this matter? Is it to any conceivable public advantage that oil-tanks should be driven through the streets, and the cost of gas making loaded by the difference between the expense of such a method of transport and pumping? But, of course, there is the principle of the thing! Yes; we are all sticklers for principle—especially when it is not necessary to pay out of our own pockets for defending it.

The Apportionment of the South Metropolitan Assessment.

THE record of the South Metropolitan rating appeals is now completed by the final judgment of the Court on the apportionments, which will be found in detail in our "Legal "Intelligence" to-day. The Company appealed against the quinquennial assessment in thirteen outlying parishes, constituting the Wandsworth and Clapham, Greenwich, Woolwich, and Lewisham Unions; having previously come to terms with the central Local Authorities whose districts contain the most valuable portion of the undertaking. It was agreed between the parties that the right method of valuing the property was to ascertain the total rateable value of the undertaking, and then, after deducting the value of the works, to divide the remainder among the different parishes in proportion to the receipts from each. A good deal of the conflict over the appeal arose upon the accidental point of the date to which the accounts should be taken. This was of great importance to the parties, but did not affect the principle of assessment. Eventually, as already recorded in the "JOURNAL," the gross value of the undertaking was declared by the Court; and when this sum came to be apportioned among the parishes, it appeared that in the Wandsworth and Clapham Union and the parish of Greenwich the assessments would remain as they stood, while in the other parishes concerned in the appeal a deduction would have to be made. In every case the deduction was very small in proportion to the whole sum involved. In the result, the total rateable value in the respondent parishes was reduced from their figure of £57,790 to £57,188. The appellants were ordered to pay the costs of those parishes in which only a nominal reduction or no reduction at all had been made. In the other cases, there was no order as to costs. Thus ends a litigation which occupied the Court for twelve days in all, in which fifteen Counsel and an army of experts were engaged, in addition to the staff of the Company. The expense in time and money has been out of all proportion to the actual results achieved; though this statement is one that may be challenged from various points of view. With all diffidence, it may be suggested that, now the business is over, and the next quinquennium is a long way ahead, it would be a good thing for the public, who pay for all, if the high contending parties could agree upon some automatic method of assessment that would prevent the recurrence of these extravagant appeals. It is a perfect scandal that the surveyors should remain in the possession of these recurrent opportunities for making trade out of such questions as that of the date of the account year and the proportion of tenant's capital. If a radical reform of the system of assessment of gas undertakings is beyond hoping for, surely some of the most vexatious accidents and incidents of appeals might be done away with.

Mr. F. Egner on Inclined Retorts.

MR. F. EGNER, of Norfolk (Va.), was in England at the time of the meeting of the Institution of Gas Engineers, and he hurried away home in order to attend the meeting of the Western Gas Association of America, at Cincinnati, where he read the paper on the use of inclined retorts in Europe which will be found in another column. Mr. Egner had, indeed, come over solely to study the system in question where it had been adopted "on this side;" his own previous experience of it having been unfortunate. Like a wise man and a good engineer, Mr. Egner formed the opinion that there must be more than this solitary experience could account for in a system of carbonizing which was undoubtedly spreading in European gas-works; and accordingly he came over to look into the subject as thoroughly as possible. His considered judgment is now before the technical world; and it is strongly favourable to the system wherever he saw it in operation. He testifies without reserve that everywhere "the charges were "seen to be evenly distributed throughout the retorts, and "well carbonized." Mr. Egner, as is the manner of his countrymen, travelled far and wide. Starting with Rheims, the birthplace of the system, he went on to Berlin, Dresden, Vienna, and Cassel—awarding to the last-named works the high praise of "the ideal." He was much impressed by Herr Merz, the Engineer of the Municipal Gas-Works of Cassel; and the general effect of what he saw of the working of the inclined retorts at Huddersfield, Brentford, and Salford only went to confirm him in the opinion, formed from his observations on the Continent, that no one after this experience "would ever seriously consider the use of

"horizontal retorts if obliged to rebuild his benches." This is a very strong expression; but Mr. Egner is not a man to shrink from stating his judgment on any matter as strongly as he feels it. He regards the inclined retort as the system of the future for the carbonization of bituminous coal; and, though he did not mention the point in his paper, he is known to have remarked in conversation while in England that for most gas-works he regards a carburetted water-gas plant, to use up some of the coke, as a highly desirable auxiliary to the benches of inclined retorts. Mr. Egner's Cincinnati paper is one of the most important technical documents ever brought under the notice of an American Gas Managers' Association. He came to Europe on his own account; but he has taken the first opportunity that offered itself for spreading broadcast the seed of his gathering here, and he is just the man to make it bear fruit. He came to inquire, remained to learn, and has returned to propagate his knowledge. We congratulate him.

Collapse of the Motor Car Prize Competition.

THE great "Engineer" motor car competition has proved a lamentable *fiasco*. For this barren result our contemporary is not to blame. It has already been chronicled in these columns how in July, 1895, when the desirability of removing the statutory restrictions upon the use of mechanical motors on common roads was being mooted, the "Engineer" announced the intention of offering prizes amounting to a thousand guineas for self-propelled common road vehicles. This intention was definitely acted upon early in the following year, when the conditions of the competition were duly framed and issued. Unexceptionable authorities were chosen for judges; and it appeared at one time that something might come of the competition. It was soon discovered, however, that an extension of time would be necessary, since none of the road motors in existence in the early part of last year were fit to be entered; and the time was accordingly extended to the end of last month. After all, though there were 70 entries, on which the fee of one sovereign was duly paid, only five vehicles put in an appearance on the trial ground. None of these was regarded by the judges as deserving of a prize, or fit to make the proposed trial run to Birmingham. We are not at all surprised—nor, we imagine, is our contemporary. The competition has at least done something—it has "cleared the air," as our contemporary declares, and shown the British public that the road motor car industry does not exist outside the imagination of the company promoter. Not until the last-named excrescence upon the mechanical engineering industry of the country is finally removed, and the road motor worked out as the bicycle has been developed, will the practical problem of mechanical traction for common roads be solved, if it is to be solved at all, which is by no means certain.

WATER AND SANITARY AFFAIRS.

THE manner in which the Select Committee of the House of Commons dealt with the Bill of the Southwark and Vauxhall Water Company, is thoroughly to be vindicated on public grounds, whatever objection may be made to it on the part of the London County Council. The question at stake was a serious one; and as such it had been recognized by the Thames Conservators, and by the High Court, which suspended the operation of the injunction granted against the Company. After the experience gained from the rejection of the East London Bill in 1893, it passes all reasonable bounds to find the County Council coming forward in another case to prevent sanction being given to a Bill which simply legalizes a supply which is not merely of a prospective character, but is actually being consumed at the present time. If it could have been shown that, by some ingenious treatment of the distributing works, a lesser quantity of water taken from the Thames could be made to suffice, there was not the slightest chance that such a change could be effected in the immediate manner necessary to meet the exigencies of the case. The Committee had to deal with an absolute emergency; and their difficulty was decidedly lessened by the circumstance that the measure before them was only of a temporary nature, preparatory to a permanent settlement to be accomplished in the next session of Parliament. The protests put forward by Mr. Balfour Browne and Mr. Freeman were entirely out of place. It was made plain that to reject the Bill would be to expose 800,000 people to the perils of a water famine. There could be no substitute for the proposed arrangement. So much water was being consumed, and there was no help for it between now and next year. There was something almost heartless in the attempt to subject a population, exceeding that of Manchester and Salford combined, to the deprivation of a large portion of the supply which they are at present consuming. No evidence and no argument could dispose of the fact that a certain quantity of water was being sent into the district, and that to diminish the quantity in any material degree would be fraught with danger to the public health. Supposing it were shown by irrefragable evidence that the mains were leaking, no adequate remedy could be provided before the session of 1898, when the whole subject can be thoroughly investigated—not by a stop-gap measure, but by a Bill which shall bring all points under review. Perhaps by that time the County Council will possess a larger leaven of common sense, and will not be disposed to run all risks for the sake of embarrassing the Water Companies and propping up the Welsh supply scheme. The argument that the Southwark and Vauxhall Company are taking more water than they need may be put in contrast with the fact that, per head of the population, the Chelsea and the Grand Junction Companies are each taking more. As a further consideration, can the County Council show where the profit comes in, when, in giving more water, the Company are put to an increased expense for pumping and machinery? We find the Council apt to say that the amount of water which the Companies supply to the people of London is not sufficient for their wants. Yet it seems that the Council would like to make the quantity less, and by every possible means to restrict it, even to famine-point.

Attention is being drawn, as in "The Times" last week, to a report drawn up by the Water Committee of the London County Council, showing the result of the analyses of the water supply for the six months ending April 27; these analyses having been carried out by the Council's Chemist. There can be no doubt as to the technical accuracy of Mr. Dibdin's results; and yet it is needful to consider how they have been obtained, and how they are to be understood. We venture to say, on practical grounds, that very erroneous conclusions might be drawn from the figures as they appear in the report. There is also in the document a passage which is particularly open to objection, and for which the responsibility perhaps rests more with the Committee than with the Chemist. A "noticeable feature" is said to consist in the number of occasions on which the microbes in the samples of water exceeded 100 per cubic centimetre; "this being, in the "opinion of experts, the maximum number admissible in "drinking water." We would ask: Who are the experts that say this? Whoever they may be—and we may place Dr. Klein foremost among the limited number—are they prepared to condemn the water derived from the deep chalk wells of the Kent Company, which exhibited, on an average, 190 microbes per cubic centimetre daily through the six months, and exceeded the standard of 100 on more than 14 per cent. of the days? On the showing of this report, the Kent water, which is actually above suspicion, had a higher average of microbes than the supply furnished by any of the other London Water Companies except two. We are not decrying the bacterial test; but we want to know what is to be understood by this standard of 100 microbes per cubic centimetre. Is it an absolute rule, to be taken apart from all circumstances? We ask our readers to compare this County Council manifesto with Dr. Edward Frankland's paper on "The "Bacteriology of Water," read at the Conference of the Institution of Civil Engineers, and given *in extenso* in our columns last week, together with the discussion which followed. Dr. Frankland nowhere enforces this standard of 100 microbes per cubic centimetre, and says it "ought "only to be applied to water immediately after filtration." It is well known that the samples of water analyzed by the Council's Chemist are not taken immediately after filtration, but are subject to all the adverse influences which affect the water as it passes through the mains. We may cite another expert, Dr. Percy Frankland, whose paper on "The London Water Supply," recently read before the Society of Arts, is in direct opposition to that which he terms the "attack" made by the County Council on the

quality of the London water. In the course of the discussion which took place after the reading of his paper, Dr. Percy Frankland contended that the standard as to the number of microbes had been entirely misapplied by Dr. Stevenson and Dr. Dupré. He explained that the standard was given by Dr. Koch merely as a guide to water engineers, showing them what sort of result they might expect from filtration. But whatever may be said by such eminent bacteriologists as the Franklands will, of course, weigh nothing with the County Council. The only "experts" they recognize are those whose views suit the Progressive policy.

OBITUARY.

The death recently took place, at his residence at Tonbridge, of Mr. JOHN COLLINS, at the age of 70 years. The deceased took an active part in local matters, and was Chairman of the Tonbridge Gas Company for some years. He enjoyed the utmost confidence and esteem of his colleagues, who were present at his funeral on Thursday.

By the recent death of Mr. HENRY H. TOWNSEND, of Bristol, at the age of 88, another connecting-link between the present and the past of gas lighting has been severed. Deceased was associated with the gas supply of Bristol for close upon half a century. He was appointed Secretary of the Bristol and Clifton Gas Company in 1837, at which time there was another Company (the Bristol Gaslight Company) in existence. In 1852, Mr. Townsend was instrumental in effecting the amalgamation of the two undertakings; he and Mr. E. Wait, the Secretary of the latter Company, being constituted Joint Secretaries. This arrangement continued until Mr. Wait's death in 1855, when Mr. Townsend took the whole of the secretarial work, which he discharged until failing health compelled him, early in 1887, to relinquish active duties. His resignation was received with great reluctance; he having always worked with the Directors on the best terms. At the subsequent half-yearly meeting of the Company, Mr. Townsend was granted a retiring allowance equal to two-thirds of his salary.

The death of Lord MONK BRETTON, which took place a few days since at the age of 72, calls for notice in our columns for the important service he rendered in connection with Private Bill Legislation, when, as Mr. Dodson, he was in the House of Commons. From 1867 to 1875, when other pressing duties allowed, he presided in the Court of Referees, and did much to establish there consistent rules regulating the *locus standi* of petitioners against Private Bills. As Chairman of Committees for many years in the Commons, and a zealous worker at all times in the department of Private Bill business, he acquired a wide—almost unrivalled—experience in this branch of legislation; and he had a well-earned reputation for the patience and impartiality he displayed both in this office and in the Court of Referees. His intimate knowledge of parliamentary practice in the Committee-rooms gave to his opinions exceptional weight upon the numerous proposals for changes in the Private Bill system which came before both Houses during his membership. He was identified with the introduction of the Provisional Order system now so largely made use of; and though on more than one occasion he favoured the establishment of an outside tribunal, he held firmly to the opinion that the Legislature was bound to retain and exercise an appellate jurisdiction. A notice of the parliamentary work of the deceased peer, by a member of the Bar evidently well qualified to appreciate it at its real worth, has lately appeared in "The Times;" and to this we are indebted for these particulars.

Mr. JAMES COLSTON, best known as Bailie Colston, of Edinburgh, died at his residence in Regent Terrace, in that city, on the morning of Sunday, the 6th inst. Mr. Colston, who was a printer, devoted himself all his life largely to public, and particularly to municipal, questions in his native city. He entered the Town Council of Edinburgh in 1865, and with the exception of three years—from 1882 to 1885—he had been a member of that body ever since. He held the position of Treasurer to the City for some years, and was afterwards appointed a Bailie, on retiring from which position he was made a Police Court Judge. At the time of his death, he was the "Father" of the Town Council. So far back as 1871, he was one of the leaders in the movement for the transfer of the Edinburgh Water Company's undertaking to the Local Authorities of Edinburgh, Leith, and Portobello; and he was for many years the Convener of the Finance Committee of the Water Trust. It was at Mr. Colston's instance that the Corporation of Edinburgh, in the autumn of 1886, took up consideration of the expediency of acquiring the gas undertakings of Edinburgh and Leith, rather than allow the Edinburgh Gas Company's Bill to pass; and the outcome was the creation of the Edinburgh and Leith Gas Commission, of which he remained a member to the end. Mr. Colston had strong literary and antiquarian tastes, and was the author of several works, the principal of which was a history of the water supply of Edinburgh. This book he wrote at the request of the Water Trustees, who had it printed and circulated privately. The remains of the deceased were accorded the tribute of a public funeral last Wednesday.

THE INCORPORATED GAS INSTITUTE.

PROCEEDINGS AT THE THIRTY-FOURTH ANNUAL GENERAL MEETING,

HELD AT

THE GUILDHALL, BATH, JUNE 15, 16, AND 17, 1897.

C. STAFFORD ELLERY, Esq., Assoc.M.Inst.C.E., President.

INAUGURAL ADDRESS.

Gentlemen,—Within a very few days the commemoration celebrations which will render this year unique in the annals of English history, will be upon us. Without any thought of politics, I feel sure I am but voicing the sentiment of everyone present when I say that, as members of an Institute representing an industry which has made great advances under Her Majesty's beneficent reign, we desire to associate ourselves with all those expressions of joy and gratitude which rise from every loyal heart, that for so long a period Her Majesty has been spared to reign over a prosperous people.

On looking through our records, I find that it is just twenty years since the Institute last paid a visit to the West of England. In 1877, the fourteenth annual meeting was held in Bristol; and now it is with sincere pleasure we welcome you to our beautiful old city of Bath. I cannot help feeling that the visit implies a compliment to myself; and I assure you, Gentlemen, I appreciate very highly the honour you have done me, and will endeavour to the extent of my ability to justify your choice. I rely on the indulgence and co-operation which have been so ungrudgingly extended to previous occupants of this chair, and trust that the meetings will pass off successfully, and the visit prove sufficiently pleasant to induce many to come to Bath again.

We miss faces to-day that were present on the occasion I refer to. In thinking of some whose absence we regret, there comes the hope that ere long it may be found possible to meet together again and present once more a united front in the interests of the gas industry; but others have been removed by the hand of death. During last year eight have passed away, whose names appear in the annual report of the Council. Of these, three were familiar figures at the meetings. Mr. Travers had been a member for some 25 years, and took a deep interest in all the proceedings. He contributed much valuable information, both in written communications and in discussions. Not long before his death he paid me a visit; and I was impressed with his shrewd judgment and careful attention to the details of any matter he happened to have in hand. Mr. M'Crae was also a member of long standing. For over 20 years he attended the meetings, and on occasions, only too rare, was heard in the discussions. Cut off in the prime of life, his presence will be missed by many. Mr. David Clarke joined the Association in 1872. He was elected to the Council in 1888, and stood by the Institute in the time of its trouble. For a year or two he broke his habitual silence, as though with a desire to render assistance when most needed; in this proving his sturdy disposition, and the strength of his attachment to the Institute. Since the report of the Council was prepared, the name of one other member, and a Past-President, has been added to the mournful list. Mr. Mitchell, of Edinburgh, died suddenly last month, having retired from active service after a very busy and anxious life. One of the most pleasing tributes to his memory is paid by a writer who says, "Mr. Mitchell was always a great favourite with his workmen and staff." I may safely add, and also with his professional brethren. Turning from the sad side, it is satisfactory to note that the ranks fill up as one and another silently drop out. With the 53 additions made to-day, the membership stands at the gratifying total

of 686. It is a matter for congratulation that so large a number of young men are coming into the Institute. We look to the new members specially for help with papers, and also in the discussions. There can be no doubt but that at the various works represented, much good research work is constantly being carried on, often perhaps in an unobtrusive way and in places not of the first magnitude, yet such that if recorded would add to the value of the proceedings and the usefulness of the Institute. Before passing to more technical subjects, it occurs to me to offer a few remarks on one or two matters of local interest.

To the gas engineer, the topography of Bath will probably suggest questions of pressure regulation in the distributing system. The district is singularly hilly; the highest point supplied with gas being about 650 feet above the works. The initial pressure is regulated by means of seven station governors, each controlling, as far as practicable, a separate district. These leading mains are connected together at convenient points with valves (for equalizing the pressure if occasion for opening them should arise), and are supplemented by a high-pressure main which serves for sending gas by day to a storage station some two miles from the works, and by night to the heart of the distributing system. No governor is used on this main; the necessary regulation being effected by those on the leading mains. On the higher ground, district governors for the automatic regulation of the pressure are employed; and in my judgment those constructed with leather diaphragms are most reliable in their action. It is, however, open to question whether any real balance of advantage is gained by introducing differential governors where the levels vary only within moderate limits. I confess to holding somewhat strongly the opinion that, if the pipes are maintained in proper condition, a little extra pressure is a less evil than any complicated system of governors and valves introduced with a single eye to possible leakage. In considering the question of pressure, it is necessary to bear in mind the various purposes to which in these days gas is being applied, and the indifference which unfortunately is displayed as to the size and quality of internal fittings, both by consumers and too frequently their advisers. I feel almost inclined to suggest that in one of the rooms of the Institute a Museum should be opened, with specimens of inferior gas-fittings and incompetent workmanship. There are few towns but could contribute interesting examples of how not to lay internal fittings. The fact has to be faced that fires and stoves are often fixed in houses fitted with pipes too small to pass sufficient gas at the pressure which formerly was considered correct. This is a matter, no doubt, which calls for larger control by the company or corporation supplying the gas; but in the meanwhile, if complaints are to be avoided, and gas is to advance in popular favour, it appears a better policy to maintain a slight excess of pressure for the consumer to draw upon than to give the impression of inadequacy when the need for fuel is felt. This applies with equal force where gas is used as a source of power. The effect of irregularity of pressure is not only to irritate the user, but to cause waste of fuel in the gas-engine. These considerations seem to lead in the direction of maintaining throughout the day a pressure nearly approximating to that given during the hours of lighting, and introducing governors, not at consumers' meters, but at each point of consumption—in other words, at the burners themselves.

The following statement is interesting as showing the tendency in recent years towards a more even load in the day and night consumption, and affords evidence of the extending use of gas for heating and power purposes. The figures give the quantity of gas sent out hourly during four winter days, and one day in May of this year, stated in percentages for more easy comparison. The day consumption, taking from 7 a.m. to 10 p.m. in the winter, has increased from 20·1 per cent. in 1893 to 25·8 per cent. in 1896, and the evening consumption has been reduced from 70·1 per cent. to 62·5 in the same period; the day consumption in May reaching 46 per cent., reckoning the hours of daylight from 6 a.m. to 8 p.m. The gas consumption on any particular day is, of course, affected by climatic conditions. But taking the figures as they stand, a steady progress in the direction of equalizing the day and night load is apparent; and the extent of the day output appears to justify the policy of maintaining a liberal pressure at the consumers' services, especially since the unaccounted-for gas, taking the average of the four years, does not reach 5 per cent. of the total make.

Hours.	Dec. 23, 1893. Hourly Consumption of Gas.		Dec. 22, 1894. Hourly Consumption of Gas.		Dec. 21, 1895. Hourly Consumption of Gas.		Dec. 23, 1896. Hourly Consumption of Gas.		May 29, 1897. Hourly Consumption of Gas.	
	Per Cent.		Per Cent.		Per Cent.		Per Cent.		Per Cent.	
6 to 7 a.m.	2·8	2·8	2·7	2·7	3·4	3·4	2·2	2·2	0·8	
7 „ 8 „	3·9		4·3		3·8		4·1		2·0	
8 „ 9 „	3·5		3·1		3·6		3·4		2·7	
9 „ 10 „	1·3		1·7		2·4		2·6		4·1	
10 „ 11 „	1·1		2·5		2·5		2·2		3·2	
11 „ 12 noon	1·1	20·1	1·4	22·9	2·6	25·3	2·4	25·8	4·3	
12 „ 1 p.m.	1·6		2·6		2·9		2·6		6·0	46·1
1 „ 2 „	2·4		2·2		2·4		2·3		4·4	
2 „ 3 „	2·4		2·4		2·1		2·7		2·6	
3 „ 4 „	2·8		2·7		3·0		3·5		1·6	
4 „ 5 „	7·7		6·4		6·4		6·9		2·7	
5 „ 6 „	9·8		10·4		9·6		10·3		3·5	
6 „ 7 „	10·7		10·3		9·6		10·1		3·6	
7 „ 8 „	10·4	70·1	10·0	66·9	9·4	63·1	9·5	62·5	4·6	
8 „ 9 „	10·3		9·9		9·5		8·7		10·0	
9 „ 10 „	9·9		8·9		8·6		7·6		16·1	
10 „ 11 „	7·3		6·9		6·3		6·0		12·5	
11 „ 12 night	4·0		4·1		3·7		3·4		5·4	
12 „ 1 a.m.	2·2		1·8		1·7		2·6		2·3	
1 „ 2 „	0·8		0·9		1·3		1·4		2·6	53·9
2 „ 3 „	1·1		1·5		0·9		1·7		1·5	
3 „ 4 „	0·9	7·0	1·1	7·5	0·9	8·2	1·3	9·5	1·3	
4 „ 5 „	0·7		1·0		0·9		1·6		1·3	
5 „ 6 „	1·3		1·2		2·5		0·9		0·9	
	100·0	100·0	100·0	100·0	100·0	100·0	100·0	100·0	100·0	100·0

In this connection, main and service laying call for a word. The serious effect of heavy steam-rollers is well known; but in these days of engineering activity, it looks as if the use of motors, of more or less power to crush and vibrate, will become more general. Already traction engines are to be seen on our roads, drawing loads of such magnitude as to suggest fractured mains and displaced services. There is much to be said in favour of the practice (where subways are not available) of laying of mains on each side of the street under the footpath; short services and absence of crushing weights being perhaps the most important. There still remains the consideration of land disturbances. This, no doubt, is of greatest interest in mining districts; but even in Bath we suffer from a landslip of some magnitude. For many years the ground over an area of some considerable extent on the side of one of the hills has been slowly moving towards the river. Buildings had to be taken down because unsafe, and so far as possible all cast-iron pipes removed and wrought tubes substituted. The strain exerted may be gauged if I state that recently, on unscrewing a 2-inch service, the ends when liberated sprang apart to the extent of some 3 inches, affording evidence not only of the tension caused by the land movement, but of the quality and elasticity of the pipe. In such cases there seems nothing but frequent inspection to avoid waste of gas. Still these considerations notwithstanding, I throw in my acquiescence with those engineers who say that the day has arrived for qualifying, if not discarding, one of the old Golden Rules for Gas Managers—viz., "Keep down the pressures."

The topographical interest of Bath is not limited to its hills. The river at times obtrudes itself somewhat unpleasantly on the notice of dwellers and workers in the valley. As it is not given to every manager to pass through the stirring experience of having his retort-houses twice flooded within the limits of one week, it might not be without interest to place on record a few particulars of what occurred here in 1894. On Tuesday, Nov. 13, in that year, the River Avon, which divides the works into two sections, was found to be rising unusually high. Rain was falling heavily, and during the morning a gang of men were told off to bay back the water which had commenced to insinuate itself at the doorways. This was successful for a time; but physical forces gradually asserted themselves, and small but innumerable "geysers" appeared over the floors and in the ashpans. The men strove for hours to save the fires by bailing. But the flood steadily rising ruthlessly defied all our efforts; and by 5 p.m. the floors were 8 inches under water, and all the furnaces put out. Each coal crusher pit being filled with water, the charging machinery could not be used. Scoops were resorted to; and the men with willing hearts tucked up their trousers to the task. Notwithstanding these somewhat unpromising conditions, the station meters recorded a make of about 1,000,000 cubic feet of gas that day, or a deficiency of

only about 700,000 cubic feet. By 6 a.m. on Wednesday the water had so far receded as to render it possible for the firemen to relight the furnaces. To my intense relief the retorts and brickwork appeared to be little the worse for this "water" treatment. All went well until 3 p.m., when a report came that the river was again rising; and before morning the experience of the previous day was repeated, with this difference only, that the second flood rose some 24 inches above the floor-level. Charging was now out of the question, even with willing men waiting to do their work. The bottom retorts were half full of water, and nothing remained but to wait and watch the rushing waters, which during the day varied the monotonous vigil by bringing down laden barges, broken from their moorings, and playfully crashing them against the cast-iron columns carrying the Company's railway bridge. Apart from bearing away the fender piles, and tearing a hole in a 24-inch wrought-iron main suspended to the bridge, no serious harm was done. By 1 a.m. on Friday it was possible to light large fires on the retort-house floors, and clear the ashpans. By 4 o'clock all the furnaces were burning; and at 6 a.m. the station meters showed faint signs of life. As a result of hard firing, carefully selecting the coals, and working light charges, some 300,000 cubic feet of gas were made on Friday, which increased to 1,200,000 cubic feet on Saturday. Gas was turned into the district late on Friday night, and the usual pressure put on the city. To complete the picture, it might perhaps be stated that the gasholders became waterlogged on Thursday, and the mains in the lower districts also filled with water, which found ingress through service-pipes broken off in cellars where the flood had floated the meters out of position. For two nights, Bath experienced the discomfort of being without gas. The electric light was switched on as usual, which somewhat mitigated the calamity; and the "run" on candles cleared out much old stock. It scarcely needs to be added that the manufacturing plant has been reconstructed on a higher level, and the inlet and outlet pipes of the gasholder lengthened. To do this, two wrought-iron bonnet-pieces were fixed over openings cut in the crown of the holder, into which the lengthening pieces pass when the top lift has for any purpose to be lowered nearly to the resting stones.

Reference to matters of local interest would be incomplete without some allusion to the fact that Bath was one of the first provincial towns to adopt electricity as a means for lighting the public thoroughfares. The electric works erected in 1890 by a private individual were subsequently purchased by a company, and this year passed into the hands of the city authorities at a figure which will return to the shareholders about one-half the subscribed capital. The company having failed to make the undertaking a financial success, many eyes will be turned with anxious interest to the report of the first year's municipal management. Corporations, of course, enjoy the privilege of subsidizing such works from the rates—a means of income denied to private companies. The introduction of electric lighting does not appear to hinder the progress of gas undertakings. Not only does each means of lighting seem to have its own peculiar sphere of usefulness, but it is most interesting to note recent developments of private installations by means of gas-engines and dynamos. From inquiries made, it appears that where the number of lamps is not less than 15, the cost compares favourably with present charges for current from the public supply. It seems strange that the convenience and efficiency of gas-engines has not yet been more fully realized by those responsible for public electric lighting installations in this country. In America, with dearer gas, it is found advantageous to use gas-engines with the "block" lighting system, under which, as the name suggests, current is supplied from several centres to save the expense of mains and subsequent loss through leakage. I am informed that, using town gas, the direct saving over central station lighting is from 15 to 20 per cent. It may not be out of place to refer to the need for some more stringent method of ensuring an observance of the Board of Trade regulations in laying conductors and consumers' wires. According to the "rules and regulations" issued by the Institution of Electrical Engineers, "the chief difficulties which beset the electrical engineer are internal and invisible—they arise from leakage and from bad connections and joints, which lead to waste of energy and the production of heat to a dangerous extent." An illustration of this danger came under my notice not long since. In a large house of business the electric wire, which had been laid too near the lead gas-pipe, fused the pipe and ignited the gas. The flame was seen in time to prevent a fire. This was fortunate for the proprietor and insurance company. The gas escaped on the outlet of the meter, which was fortunate for the gas company. Equally urgent is the necessity for some proper understanding as to the laying of underground conductors, so as to avoid as far as possible the crossing of pipes and services alike in the interests of electric light and gas companies. There is one point in connection with this subject that strikes the observer as somewhat strange, and that is the perfect confidence with which the public accept the sanguine estimates of electrical experts as to the illuminating effect of the lamps. While gas is tested under conditions and with restrictions of the most exacting nature, yet "the fickle beauty" is permitted to flutter on sometimes bright and anon quite dim, and no one thinks of asking, Is the official tester satisfied? Perhaps this may not always be, and some day we shall have the pleasure of knowing accurately what amount of light comes from a 16-candle power incandescent lamp, and what discount has to be allowed on, say, a 1000-candle power arc light.

Passing to the geology of the district, and quoting the Rev. H. Winwood: "Within an easy day's walk of Bath no less than thirteen or fourteen formations can be traversed, from the mountain limestone to the alluvial deposits." Of the coal measures, I will simply say that in the Radstock district, which consists of two main divisions—the upper and lower—there are, to quote another authority, "some fourteen veins, none exceeding 3 feet in thickness, some no more than 14 inches." In the Bristol district the Parkfield Collieries have four veins of gas coals, the thickness being between 2 and 3 feet; while at the Kingwood Colliery there are worked three veins of steam coal varying from 2 feet to 4 ft. 6 in. in thickness. Quoting again the same authority: "The Somerset and Radstock coalfields are richer in fossil plants than any other coalfields in Britain." Many of these may be seen at the local museums. Passing over the various other strata, I ought perhaps to refer to the "great oolite," for which this neighbourhood has long been famous. There is a danger to-day of tarnishing its fair fame by the indiscriminate use of inferior material. An inspection of the masonry remaining as a memorial of, not only the constructive ability, but also the selective skill of the ancient Romans, witnesses in a measure and manner to the permanent character of properly selected stone which is not evidenced in some of the more modern structures. By the kindness of the Directors of the Bath stone firms, one of the most interesting quarries from which the stone is worked will be open to inspection on Wednesday, and information may then be obtained, both of scientific and practical value.

The historical associations and ethnological history of Bath can only be mentioned to say that, by the kindness of the various bodies concerned, opportunity will be furnished for visiting the Roman remains, museums, and baths. After contemplating these, I recommend the seeker after "perfect ease and health" to make trial of the waters of our healing springs, which for centuries have, by judicious application, both within and without, done much to relieve the distress and lengthen the lives of multitudes suffering from those painful affections of the muscles summed up in the one word "rheumatism."

Turning to considerations less local, the first thought that seeks expression is that, competition notwithstanding, we meet at a time when the gas industry is prospering and progressing. In looking through the "proceedings" of the Institute, there stand out periods of special activity in engineering achievement and scientific discovery. Not to go further back than my personal experience, there was in 1874, as the absorbing topic, the use of concrete in constructing gasholder tanks. Following with more or less intervals of time came—

Mechanical stoking,
Improved methods of purification,
Gas-engines,
Regenerative furnaces,
Regenerative burners,
Inclined retorts.

It is gratifying to note that to-day we are in the midst of a period of special activity. In the manufacture, distribution, and combustion of gas, great strides are being

made. Before touching on these, I desire to bear testimony afresh to the service rendered to the industry by the science of chemistry. In recent years, our eyes have more than ever been turned in the direction of the laboratory; and the fact must be patent to all that a knowledge of chemistry is becoming increasingly essential in the training of a gas engineer. I venture to think that, not in greater gasholders or altered methods of guiding them—not, in fact, in any engineering feats of economy, however admirable and necessary these may be—but it seems most probable that advances in the near future will come rather from discoveries by chemists and scientists in extracting more gas from the raw material, and effecting greater economy in its use.

The introduction of plant for the production of carburetted water gas takes a large place in the present period of activity. For some seven years oil has been used in conjunction with some suitable carrier as a substitute for coal and cannel in English gas-works; and it may now be claimed that the time of probation is passed, and the process established on the firm foundation of economical efficiency. It is a pity perhaps the gas was not introduced under some other name. The tendency is to shorten the title to plain "water gas," which creates prejudice and wrong impressions in the minds of the uninitiated. My attention was first drawn to the question of producing illuminating gas from decomposed steam in the year 1878, when consulted by a Syndicate, in the town of Worcester, to report upon a process patented by a Mr. Stephan for converting water or sewage into a "burnable and luminous gas." The process was thus described: "Steam is generated from sewage in a boiler, passed through a retort filled with closely packed metal or perforated discs, thence to a carburettor, consisting of any suitable material, such as bones, chalk saturated with petroleum, coal, sawdust, or creosote, or the residue from the boiler in which the sewage was evaporated."

Writing on the subject at the time, a local paper summed up the matter in the following words: "Mr. Stephan not only apparently solves the gas question, but he also disposes of the sewage difficulty which has engaged the attention of so many scientific minds. Under Mr. Stephan's process, all sewage matter is to be easily disposed of, gas produced free, gratis, for nothing, and yet an immense profit be made." Now, in this process, spite of its errors, there seems to be something akin to the more perfect idea of to-day; and it is but fair to the patentee, who received but little reward for his labours, that so much should be unearthed. Of carburetted water gas as now manufactured much has been written by those who understand the subject, and, as is not unusual, by some who know but little. After an experience of some eighteen months, I have to express a feeling of indebtedness to those engineers who worked out and brought over this system of gas manufacture from the United States. At first its chief advantage was considered to consist in its being an easy and economical enricher of coal gas; and its merits in this direction are too well known to need enlargement. But to-day its field of usefulness is found to be less limited.

The manufacturing capacity of plants already erected, and in course of erection, is said to be equal to a daily make of 83 million cubic feet of gas; and they range from 125,000 cubic feet upwards. Assuming each plant to be operated during 100 days in the year, the output of carburetted water gas would be about 8300 million cubic feet, or an equivalent of, say, 830,000 tons of coal. The effect of this displacement must be far reaching. The pressure of the demand for cannel coal has already been removed, and now the keen interest with which friends of the industry scan reports of "the situation in the coal trade" begin to be lessened. The substitution of oil for some portion of the coal used should have a steadying effect upon the market, and diminish those convulsions to which it has too frequently been subjected, and further make available certain coals which hitherto have been considered unsuitable for extensive use in gas-works, because an inferior gas may now be so economically enriched by means of oil. The economy of space, not only in the erection of the manufacturing plant, but also in storing oil as compared with coal, is noteworthy, especially for those works where ground is limited. Taking 26 gallons of oil as the equivalent of 1 ton of coal, the relation is as 1 to 10, or, put in another way, the oil equivalent of 1000 tons of coal will require only 208 square feet of ground if the tank be 20 feet high. The substitution of coke for some portion of the coal needed in gas making is a further advantage. The material is always on the spot, sometimes in inconvenient quantity, and may be used hot from the retorts. Year by year the output has been increasing, at times beyond the limits of demand; and a larger "home" consumption will certainly tend to enhance its value. To a degree perhaps not so great, the extended use of oil gas should assist the market for other residuals, such as tar and liquor. Looked at from the labour point of view, an oil-gas plant presents perhaps its brightest side. A few men physically unfitted for retort-house work can here manufacture gas without strain; the only arduous part being in connection with the removal of clinker from the generators once every eight hours. It looks as though the day may come when, by using retorts for coal in the summer, and meeting the heavy winter demand by oil gas, there will be less disparity between the number of hands employed in summer and winter, and the need for reducing the staff in the spring will be removed. The ease with which sudden fluctuations in the consumption of gas can be met by the use of this plant, is a point of the greatest importance. Instead of the bustle to light up retorts to stay the downward course of gasholders in winter, the simple turning of handles now suffices, assuming sufficient steam to be available; while with equal facility can the illuminating power be altered at will. Although the removal of the carbonic acid requires an increased expenditure on lime, it must be noted that the small amount of sulphur in the gas not only lowers the percentage of sulphuretted hydrogen, but reduces the other and more troublesome sulphur compounds.

It may be expected that I should say something about the carbonic oxide present in the gas; but, speaking frankly, I see so little practical importance attaching to the question that, beyond remarking that the ordinary precautions necessary with coal gas need to be observed, I have nothing to add, unless it be to record the experience of an American engineer who recently informed me that for a time he had quite an epidemic of "gassing" among his service layers, when at work in the streets. On inquiry it turned out that with characteristic generosity passers-by paid for certain stimulants for the sufferer; and it was only by issuing a notice that any man found gassed would be dismissed the service of the Company, that this imposition on the public for "free drinks" was stopped.

The "dark" suggestion has been made to me that, in a recent agitation against the introduction of carburetted water gas to a town of some importance, the fear of "consequences" was most felt by gentlemen interested in the coal trade. Now I have too high an opinion of the fortitude of these gentlemen to accept such a suggestion as correct. It has but to be mentioned to show its utter unreasonableness, and for ever silence such calumny!

An inquiry into the question of the specific gravity of various gases, and actual experiments with lead and iron tubes, also with meters and burners, prove that the pressure needs to be increased in direct proportion to the percentage of oil gas distributed. The figures show, not only that the discharge of water gas is from 18 to 20 per cent. less than coal gas at a given pressure, but that the theoretical discharge with coal gas is not obtained with some tubes freely placed on the market. Experiments made with burners revealed the same difference, and with a three-light dry meter it was slightly more. The gas used was about 16-candle illuminating power in each case. It appears therefore in round figures that with 25 per cent. of oil gas and 75 per cent. of coal gas, the discharge is less by about 5 per cent., and with a mixture of half-and-half by about 10 per cent., than with coal gas only, and that to pass an equal quantity, the pressure must be proportionately increased. One feature of some importance should be here noted as affecting the examination of mixed gases. The greater brilliancy of the smaller flame of carburetted water gas so increases the light passing through the Methven screen and other standards which utilize a portion of the gas-flame in place of candles, as to render it useless unless the mixture be definite and constant, and the slot accurately adjusted.

The question of the supply of oil arises; but the tendency appears to be for prices to fall as the demand increases. This no doubt is in some measure due to the improved facilities for importing the oil rendered possible as the market expands sufficiently to justify the necessary outlay.

According to accounts from Roumania, petroleum is said to exist there in large quantities; and doubtless supplies will be forthcoming from other centres as the need arises. In this connection it may not be out of place to add that experiments have been made successfully to enrich water gas by means of cannel coal; and the future may have surprises in store with regard to possible modifications in the manner of treating ordinary gas-making coals so as to produce a richer gas as a substitute for some portion of the oil.

In figuring the cost of production, it is a task of no small difficulty to assess the money value of what have been well termed the "collateral" advantages of oil gas manufacture; and yet, to give due credit to the process, these items must be taken into account. In comparing with coal gas, local circumstances also very much affect the figures. Speaking with reference to one town, I find it safe to say the cost of producing carburetted water gas is appreciably less than coal gas at present prices of the raw material and bye-products. I look upon this process, however, simply as an auxiliary to the existing method of manufacture; and it must be said that with this "auxiliary" at hand, the routine of the retort-house proceeds with a smoothness and comfort previously unknown.

Improvements introduced into retort-houses themselves in late years have also largely tended to economy in working, while reducing the physical strain on the worker. Mechanical appliances for breaking, elevating, and conveying the coal, machinery for the drawing and charging of retorts, and improved furnaces for consuming the fuel have each contributed to the result. How far the system of inclined retorts may advance in favour, it is not easy to-day to tell; but any new system introduced at a time when the labour cost has been reduced to about 2d. per 1000 cubic feet made, has a task of no small difficulty if something better is to be shown. The various schemes which from time to time have been suggested for carbonizing tar prove not only the interest of the subject, but the difficulty of once and for all demonstrating the actual value of this product of the destructive distillation of coal. I had hoped the programme of these meetings would have contained a paper with further particulars of the process in use at Widnes. The effect of mixing the tar from the hydraulic mains, and also from the carburetted water-gas plant, with the coal as it passes from the stores to the retorts, is to increase the yield of gas. Possibly to some extent this is due to the physical condition of the coal after treatment. The coal contains a considerable percentage of small; and it is found from careful experiment that mixing tar with the dust in the proportion of 3 pints to the cubic foot, the coal occupies a space over 10 per cent. greater than it did before treatment. The particles do not lie so closely together; and consequently the material is in a condition more favourable for the processes of distillation. The increased yield is doubtless also due to the gas-producing power of the tar, which may be taken as from 17,000 cubic feet to 20,000 cubic feet per ton. The efficiency of this tar treatment depends in a large measure upon the hygrometrical condition of the coal. Whether the importance of using dry coal for gas making is fully realized, is a question that may well be discussed at some future meeting. A further effect of using tar is to improve the coke, and also to lessen the trouble caused by thick tar forming in the hydraulic mains.

From the consideration of its manufacture, it is an easy transition to discuss improvements in the means for utilizing gas. The presentation of the Birmingham Medal to Dr. von Welsbach marks the sense of the Institute of the signal services rendered to the industry by his improvements in the incandescent method of gas lighting. It is only by comparing the amount of light now obtainable from a ton of coal that the true extent of recent advances in means of lighting can be fully realized.

Taking the yield of gas at 10,200 cubic feet per ton of 16 candles, which happens to be the return in this city, the comparison is as follows:—

	Candles per Ton of Coal.		
An ordinary common burner with an efficiency of 2 candles per foot of gas consumed	20,400	..	52,000
The London Argand at 3·2 candles per foot	32,640	..	83,200
The "Welsbach" incandescent at 16 candles per foot	163,200	..	416,000
The "Denayrouze" at the figure given by Professor Lewes in 1895—viz., 27 candles per foot	275,400	..	702,000

To carry the comparison a little further—

With 16-candle power electric glow lamps, using a gas-engine consuming 22 cubic feet per indicated horse power, and estimating ten lamps per indicated horse power	74,192	..	189,120
With similar lamps using a steam boiler and engine with a consumption of 3 lbs. of coal per indicated horse power. In this case, however, there are no residuals, such as coke and tar	119,456	..	
For the sake of making the comparison complete, assume the coke to be converted into carburetted water gas, say, 50 lbs. produces 1000 cubic feet, the coke available as 9 cwt. =	20,160 cubic feet		
Less gas from oil used =	4,250 ,, ,,		
	15,910 ,, ,,		
The figures work out thus:			
Gas from coal	10,200 ,, ,,		
Gas from coke	15,900 ,, ,,		

Or, say, 26,000 cubic feet from each ton of coal

The second column shows the candle power based on this yield.

I am reminded that the efficiency of the "Welsbach" burner to a large extent depends on the regulation of the consumption of gas and the adjustment of the air supply; and no doubt it is of the first importance to give this matter attention, if the best results are to be obtained. Equally essential is it to periodically examine and clean the burner, which observation once more accentuates the suggestion that gas authorities need to extend their interest in the supply even to the point of combustion, by undertaking at a fixed charge to maintain the burners in an efficient condition.

For ordinary street lighting, "Welsbach" burners, with bulbs instead of chimneys, and enclosed in the new lanterns, which are glazed with shaped glass so adjusted as to reflect the light to the roadway and path where most required, produce a striking effect without any increase in the consumption of gas. Various estimates have been given; but it does not seem safe to calculate on less than an average of five mantles for renewals per annum. It is greatly to be desired that further improvements in the direction of durability will be effected. That finality is not reached even in Welsbach burners is shown by Professor Lewes in his experiments with "Denayrouze" burners in 1895. He states that with a consumption of 9 cubic feet as much as 250-candle power is obtained, or over 27 candles per foot. It is a matter of satisfaction that these burners are now being put on the market; and although in the modified form this high duty is not obtained, yet clusters produce an amount of illumination far in advance of anything yet achieved. If the larger mantles can be made sufficiently durable, and chimneys dispensed with, another important step will be taken in the direction of economical public lighting.

Speaking of present activity, mention must be made of the favour with which prepayment meters are received by the public. Putting the consumption at 12,000 cubic feet per meter, the total gas sold in this manner must gratify the most pessimistic. Opinions seem to differ as to what the extra charge per 1000 cubic feet sold under this system should be. When it is considered that special inspection and collection are necessary; that many houses become void after the pipes are laid in, and the ingoing tenants sometimes decline to use them; that the meters are still far from perfect, and in a few years will probably involve considerable cost for repairs; further, that the maintenance is high, some customers not being quite so careful in putting pennies in as they might be—it does not seem unreasonable to add 10d. per 1000 cubic feet where the rent of meter and fittings is included. The popularity of coin meters among one class of consumers appears to point in the direction of a more extended use of the prepayment system. It is a question whether it would not be a wise policy to give every applicant for a supply of gas a choice of both systems. The penny meter is already supplemented by the shilling meter; and this in its turn may be altered for use with coins of higher value. I would throw out a suggestion here, especially to makers of cooking stoves. That many persons would be glad of some means by which to check waste of fuel, is clear to all. A simple contrivance might readily be attached, when desired, to cookers, by means of which the consumption of gas might be limited to any desired daily outlay. A coin meter serves the purpose; but in these forward days some-

thing more simple and less costly should be possible. Indeed, it is a fixed idea in my mind that for the ordinary registration of gas, a simpler, smaller, and less expensive instrument will yet be devised. I was much struck with some remarks made last September by the President in his address to the National Association of Colliery Managers: "Another reason undoubtedly for the slackness in the coal trade was that gas companies had in many large centres offered to supply and erect free of cost gas-stoves in all buildings within their district. This question is one of the most serious points the coal trade has to fear." This is an interesting testimony to the growing popularity of gaseous fuel. To complete the picture, another report appeared of a case in one of the London Courts. A chimney sweep was summoned by a money lender, who considered himself aggrieved through not receiving his just due. The sweep's plea for mercy was that his trade was ruined by the extended use of gas fires and stoves. Both statements are doubtless founded on fact. The conversion of coal into gaseous fuel in retort-houses does tend to check the waste of our rapidly diminishing store of mineral wealth, and at the same time prevent the pollution of the atmosphere by that unburned carbon which, in spite of the evidence referred to, is still too prevalent.

A new development in mechanical traction has been inaugurated during the past year. It is interesting to find the experiment tried at Blackpool has led to the proposal of introducing gas traction into other towns. The news comes from Paris that boats are now propelled by gas-engines, and attain a speed of some seven knots an hour; the gas being supplied from on shore, and stored on board in steel holders under a pressure of 800 lbs. The many developments of methods for utilizing gas for heating purposes lend force to the suggestion that not only is a photometrical test necessary, but that its calorific value will eventually be watched with as much care as its directly illuminating effect. In view of the lecture kindly promised by Professor Lewes, I refrain from further reference to this subject, except to state that experiments so far go to show that the difference in the calorific value of coal and water gas of about 16-candle power does not appear to exceed 5 per cent.; and when mixed, the slight loss must be inappreciable.

Before putting down my pen, I would add a word on the question of Sunday labour. Some months since a circular was addressed to 1600 gas managers on the important subject of reducing Sunday labour in gas-works. The question has been discussed from time to time, and a sympathetic interest manifested by many members; but as one deeply interested in the matter, perhaps it may lead some who yet doubt the possibility of stopping work on Sundays without considerable loss if I say that last year we closed the works—

29 Sundays from 6 a.m. to 10 p.m.
17 „ „ 6 „ 6 „
5 „ „ 6 „ 2 „

only permitting those men to work who are required to put coke in the furnaces or do repairs only possible when the works are stopped. The effect on the retorts may be to some extent detrimental; but the gain to the workmen, in rest and moral tone, more than compensates for the trifling cost of repairs. After stopping all Sunday labour not absolutely necessary, I am really surprised to find how much it is possible to dispense with; and I confidently recommend the experiment to any, if there be such, who have not yet ventured a trial.

I should like to have said something on the labour question, but am conscious of having already transgressed in the matter of time. I will only add that at no period in the history of the industry has it been more necessary to make employment in a gas-works as attractive as possible, in order to secure the interested service of the best men. This applies throughout, even up to the highest grades in the service, and cannot be urged with too much insistence in these days of activity and competition.

Gas v. Electricity in Cotton-Mills.—According to Mr. J. P. Haslam, J.P., who is a member of one of the largest cotton spinning and manufacturing firms in Bolton, the electric light is not the best illuminant for cotton-mills. Speaking recently at a meeting of the Heaton Parish Council, he said his firm had gone thoroughly into the question of substituting electricity for gas in their various mills, and had decided to retain the gas. One reason for this was that gas had a warming power and a moistening influence, which electricity had not, which was advantageous to the cotton operatives.

ESSAYS, COMMENTARIES, AND REVIEWS.

GAS AND WATER COMPANIES IN THE STOCK MARKET.

(For Stock and Share List, see p. 1372.)

THE Stock Markets opened on Tuesday in a very languid condition after the Whitsuntide recess; and business never got up any degree of activity at any time during the week. The wretched weather at first operated unfavourably for the railways; and the general tendency remained dull for awhile. But later on the disposition became firmer. In one or two special quarters, as the American and the Mining Markets, some nice improvements were effected. The leisurely progress of affairs in Greece left the Foreign Market unaffected. Altogether, business was decidedly quiet; and it seems bound to remain so for at least another fortnight. Ascot this week and the Jubilee next week will seriously interfere with things in Capel Court. The Money Market is practically unchanged. The Stock Exchange settlement produced some demand; but it was quite inadequate to have any perceptible effect on the resources of the market. Gas securities had the quietest week they have had for a long time past; the whole volume of transactions being about equal to a couple of days' decent allowance. But the feeling was very good; and what changes of quotations were made were all for the better. Several choice debenture issues were quoted *ex div.*, and gained substantially in the change. In Gaslights, the "A" was only moderately dealt in. The price was very steady; and 315¼ was the mark on the opening and the closing days. Nothing remarkable was done in the secured issues. A couple of transactions comprised all that was done in South Metropolitan; while nothing at all was marked in Commercials. The Suburban and Provincial division, too, were quite devoid of interest, with scarcely a transaction effected in them, and no change in quotation. The Continental group shared in the general repose. Imperial was steady, and Union was unchanged. But European part paid rose in price; while the fully paid commanded top figures. Among the rest, the only noticeable incident was an advance in Buenos Ayres. In the Water Companies, business was pretty good, considering the prevailing quiet. Prices kept well up; and one or two quotations advanced.

The daily operations were: Business in Gas on Tuesday was very quiet; but the tendency was all in favour of continued firmness. European part paid advanced ½. In Water, Southwark ordinary rose 2. Wednesday was almost a blank day, not half-a-dozen transactions being effected. Quotations did not move. On Thursday, the sum-total of dealings in Gas amounted to four—almost a "record" for quiet. But Buenos Ayres rose ¼. In Water, Kent improved 3. Friday's business was a little better; but still it must be called very quiet, and no change in price took place. Saturday was naturally quiescent too. But prices were very steady; and quotations closed without further change.

ELECTRIC LIGHTING MEMORANDA.

The Latest Wonder of Electricity—Hertzian Undulations—Marconi's System—His Triumph.

THE latest advance of electric science, now engaging the attention of the journals devoted to the subject, has nothing to do with the production of artificial light or the transmission of power, but is in connection with the earliest practical application of electricity—to signalling purposes. In its way, it is as great a wonder as anything that electricians, who occupy in the estimation of the modern public the place of the magicians of an older time, have ever done. Briefly stated, it is nothing more nor less than a practicable system of telegraphy without wires, by the adaptation to this purpose of Hertzian waves; and success has been achieved with it to the extent of printing off a message at a distance of nearly nine miles. Strictly speaking, of course, this remarkable novelty lies outside the ordinary range of our notice; but we entertain the opinion that our readers like to be kept posted up in regard to all important electrical matters. And as this particular novelty has been considered worthy of being introduced by Mr. W. H. Preece to a Royal Institution audience, and his statements concerning it are sure to be garbled in going "the round of the Press," the facts had better be put on record. The difficulty in explaining in popular language any fresh triumph of physical science, lies in deciding where to begin. This was the trouble in regard to the Röntgen phenomena, for example; for whereas, the moment this discovery was announced, men of science all the world over recognized it as being but a step in advance of what was previously known, and consequently were able to follow it with ease, the popular mind had to be stirred to a great depth with preliminary instruction before it could grasp the significance of the new fact awaiting comprehension.

So in the present instance, it is easy to set the popular mind agog with a story of an invention that enables messages to be sent through miles of space, and in complete disregard of such intervening obstacles as brick walls and deal doors; and the matter is not rendered clearer by stating that this is done by means of Hertzian waves. The ordinary man will naturally

inquire what are Hertzian waves, and where are they to be met with? Hereby, of course, hangs a tale of research in the first place inutile, and after a lapse of time made useful by other hands, through means that the original investigator knew not. We shall endeavour to summarize such information relating to the subject as is vouchsafed by Mr. Preece and our leading electrical contemporaries. Not more than ten years ago—to be precise, it was in 1888—Hertz demonstrated experimentally that Clerk-Maxwell's theory of electric waves was true, and that it was possible to produce such waves, and cause them to excite apparatus suitable for the purpose at a distance from their source. These Hertzian waves, as they were called, were of the same nature as the waves that are perceptible by us as light, only they were not nearly so rapid. They could, however, pass through obstacles not transparent to light; and their existence was manifested by their action upon a "resonator" tuned to the same frequency of vibration as the transmitter. This was not done over a greater distance than a few yards; and the result was a mere scientific curiosity. Two years later, another worker in this field of promise—M. Branly—made a simple and extremely sensitive apparatus for the detection of electric waves. It consisted of a glass tube filled with metal filings, connected to an external circuit by platinum electrodes fused through its ends. This appliance was called a "coherer," because it was supposed that the passage of a current made the metallic particles stick together temporarily, and so reduced resistance.

Then Signor Marconi, the man of the hour, took up the subject, and set about the improvement of the coherer and its adaptation to work with the Hertzian arrangement, as modified by Professor Righi. It is not for us to describe in full the apparatus constructed by Marconi and brought to England last July. He appears to have been taken up by Mr. Preece from the beginning, which is the less to be wondered at, inasmuch as Mr. Preece had been trying his hand at long-distance signalling without wires in the Bristol Channel and at Oban, with partial success. An effort to establish communication from the shore to the North Sandhead lightship on the Goodwins had proved a failure. Marconi succeeded at once on Salisbury Plain in telegraphing to a distance of four miles. Where there is a clear open space, and the stations are in sight of each other, the necessary apparatus is compact and simple. When there are obstacles in the way or the distance is great, it is necessary to be able to command a height; and for this purpose tall masts or balloons have been employed. In this way a distance of nine miles has already been covered; and the limit has by no means been reached. It is easy to transmit many messages in any direction at the same time. Again, the essential part of the Marconi apparatus can be made to respond even if shut up in a perfectly closed metallic box. At the Royal Institution, a profound impression was made by the ringing of electric bells shut up in iron boxes and carried about the room; the impulse being imparted by Signor Marconi from the cellar below.

These are the facts; the applications will come in due course. To the professor of physical science, as Mr. Preece observed, Marconi has not effected anything new, or disclosed anything that was not previously known. "He has not discovered any new rays; his transmitter is comparatively old; his receiver is based on Branly's coherer. Columbus did not invent the egg, but he showed how to make it stand on its end; and Marconi has produced from known means a new electric eye more delicate than any known electrical instrument, and a new system of telegraphy that will reach places hitherto inaccessible." That is enough for one man's reputation, in the estimation of the public. If we are enabled by Marconi to ring a bell in any part of a large works from the manager's office, or to read off on shore a message sent from a vessel outside the harbour, this will be ascribed to him for genius, and genius of the particular kind that the world most appreciates at the present time. Mr. Preece admits that there are a great many practical points connected with this system that require to be threshed out in a practical manner before it can be placed on the market; but he rightly claims that "enough has been done to prove its value, and to show that for shipping and lighthouse purposes it will be a great and valuable acquisition." Not the least of Marconi's triumphs has been to prove that the great British Post Office is not impervious to new ideas brought in by outsiders; and another is the encouragement he has given to pure research.

PERSONAL.

At the last meeting of the Blackburn Town Council, the salary of Mr. S. R. Ogden, the Gas Engineer, was advanced by £50 per annum.

Mr. Patrick Conroy, who served his apprenticeship at the Galway Gas-Works, has succeeded the late Mr. P. J. Salmon in the office of Manager. There were 56 candidates.

Mr. G. B. Smedley, the Manager and Secretary of the Beaumaris Gas and Water Works, has been appointed assistant to his father, Mr. G. Smedley, at Buxton. Mr. J. E. Hughes, of Holyhead, will succeed Mr. Smedley at Beaumaris.

Mr. E. J. Castle, Q.C., who has lately been appointed Recorder of Bristol, will be known to many of our readers, either personally or by repute, in connection with assessment appeals; his work on "Rating" being a standard authority.

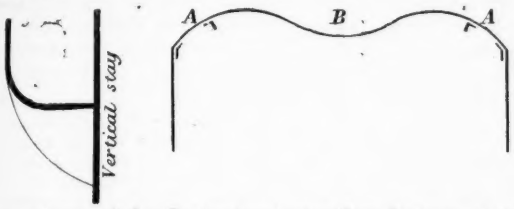
THE INVERSION OF AN UNTRUSSED GASHOLDER CROWN.

An interesting operation in gasholder construction is now in progress at the South Metropolitan Gas Company's Old Kent Road station, concerning which we have been invited by Mr. George Livesey to make a statement, as he rightly considers that some of the features of the work are likely to be of interest to gas engineers. Briefly put, the chief point to note in this work consists in the 180 feet gasholder being hung up, with the untrussed crown inverted, while the construction of a new additional inner lift is being proceeded with underneath it. The circumstances that have led the Chairman and the Chief Engineer of the Company (Mr. Frank Livesey) to adopt this expedient are these: The gasholder, which is telescopic, with lifts 180 feet and 177 feet diameter respectively, occupies the first concrete tank designed by Mr. G. Livesey twenty years ago, when he was Engineer to the Company—such a work being at that period experimental. The tank was mentioned by the late Mr. W. Richards in a paper read before the British Association of Gas Managers in 1878; the experimental construction of it wholly of concrete, rendered on the inside with pure portland cement, being characterized as of "remarkable boldness." Puddle was entirely dispensed with—it is believed for the first time in connection with a work of this kind and magnitude; and the author of the paper described the tank as being, "on the whole," successful. This qualified expression of approval brought up Mr. Livesey in the subsequent discussion. He gave an account of the work, in which he stated that the tank was 184 feet in diameter and 45 feet deep. When filled with water to about 30 feet of the top, it remained sound for some months, while the holder was being built; but when it was filled up to the top water-line, five or six small cracks started, and parted the thick concrete wall from the top nearly to the bottom. These cracks opened quietly to about 1-16th inch wide, and were vertical, or nearly so. There are no iron bonding-bars in the tank wall; the Engineer relying wholly on the tensile strength of the concrete, with a rammed backing, to withstand the pressure of the water upon the inner surface. Mr. Livesey was to some extent victimized for his misplaced confidence in the strength of the unassisted concrete; and he has always used bonding-irons since. But practically the effect of the cracks was slight; vertical fissures of the character developed in this example being easily stopped. The record of the tank and its cracks, however, was sufficient to warn the Engineer for the holder enlargement now in progress from lowering the water in the tank to a depth such as would involve a fresh disturbance of the equilibrium of the structure upon refilling.

Hence the practical problem was how to get at the whole of the holder for overhauling and necessary repairs, and for building the new inside lift over the 35 feet of water or thereabouts remaining in the tank. The crown, it should be premised, was untrussed; there being the usual permanent wooden scaffolding underneath it. The inner lift, as already stated, is 177 feet in diameter; the crown originally rising 9 feet in the centre. Thus it could not be described as belonging to the category of what the older gasholder builders were accustomed to term "flat crowns"—once considered to be the proper concomitants of an absence of trussing. The top curb was on a principle of construction at once strong and simple, and one that has since become general in the case of large holders. The actual curb is an angle-iron, 6 in. by 6 in. by ¾ in., to which is riveted a ring of strong plates, ½ inch thick, that form the first row of crown sheets. To keep this ring in its proper rigid shape as a flat circular girder, it is strengthened below on the inside edge of the plates by a deep angle-iron. The whole curb, therefore, is a plate girder, not likely to be deformed by any strain coming upon it edgewise from the guide-framing, or, on the flat, from the crown sheeting failing to find proper support at all points on the scaffolding when the holder was emptied of gas or air. The inner lift had large and semicircular vertical stays, "like hydraulic mains on end," as Mr. G. Livesey describes them—quite superfluous, of course, but deemed necessary at the time. The hydraulic cup and grip was of Piggott's pattern, of bent plates. The tank is practically annular; the "dumpling" left in the middle being very large. So narrow is the bottom, where the rest-stones are, that the deep vertical stays of the inner lift had to be cut away at the bottom, to enable the cup to come down upon its bearings when the holder was empty.

Keeping all these conditions and local circumstances in mind, it will be perceived that several difficulties had to be faced when it became necessary to repair and enlarge the holder. How was the inside life to be supported, seeing that there was no room for it upon the rest-stones, which were, moreover, 35 feet under water? A new crown had to be made; the old one having been built too light to carry the extra lift, and being in a worn and leaky condition. A good deal of the riveting of the side sheets had also to be cut out and made good; and there were the rollers to see to and renew. The old guide-framing, be it noted, was to remain at the original height; the third lift coming out of it when raised. After several expedients had been proposed between the Engineers and the Contractors—Messrs. S. Cutler and Sons—Mr. G. Livesey hit upon the idea of fixing brackets to the lower end of the reconstructed vertical stays of the old inner (now to become the intermediate) lift; the deep

semicircular members being removed, in the style shown by the accompanying diagram. These, placed at a height sufficient to clear the interfering "dumpling," enable the one lift to carry the other on the occasions when it will be grounded. Simple as the expedient appears, it not only met the one difficulty, but also served to overc me another—that of the construction of the inside lift *in situ*.



The scheme of the Contractors' operations became at once clear and simple. After the water in the tank had been lowered, the inside of the holder was carefully and thoroughly ventilated. To this end a temporary air-shaft was lowered from a manhole to near the surface of the water, and a strong air-blast kept up for some days—other openings being made in the crown. When all was safe inside, the two lifts of the holder were fastened together, the manholes closed, and the holder blown up with air as high as it would go. When this level was reached, strong hooks were placed in position round the edge of the tank, and caused to take the weight of the two lifts. This secured the holder in its elevated position; but the question of gaining free access to the interior remained. Mr. G. Livesey and his engineering assistants consequently set about repeating the experience of fifteen years ago, when they had a smaller untrussed crown—a "flat" one at that—to deal with similarly. In the present case, the fact of the crown having a considerable rise was felt to be a complication that might give some additional trouble in making the passage from the state of being domed to that of sagging. The operation of letting the air out was therefore conducted with much precaution. As in the opposite case of the inflation of a balloon, the proper raising of the somewhat heavy central valve in the top of the membrane has to be assured before the rest of the business is proceeded with, so in this process of deflating a gasholder destitute of roof trussing, and hung far above the crown scaffolding, the movement of the centre B in the proper direction is of the first importance. The blower was kept ready to reverse the process on the instant; all the engineering strength of the Company was assembled on the watch—the Chairman in command; and a weight of 2 cwt. placed in the middle of the crown. So the air was gradually let out. Before long, however, a halt was called. The crown was observed to be sagging, not in the centre, but round the haunches. This would not do; and to correct the movement, the weight in the middle was increased to half a ton. Then deflation was resumed; and it was soon perceived that the dome was beginning to pit in the middle. This depression spread gently and quietly, but not at first with perfect regularity all round. The sheeting was evidently tighter in one place than in others, and so a radial groove started from the centre and extended almost to the curb. In time, however, this radial depression disappeared, and the sheeting eventually came to rest in the form shown (exaggerated) in the diagram.

The entire operation was safely carried out, and, with a small exception to be described, the crown sheeting appears to be none the worse for it. The exception refers to the junction of the strong plating of the curb-ring with the next row, at the point marked A A in the diagram. Here, where there are three thicknesses of metal, two or three cracks just wide enough to admit the blade of a penknife have shown themselves; indicating that the metal, having been strained in one direction for twenty years, has failed to some extent under the reversal of the strain. This is not a matter of any importance as regards the future of the gasholder, inasmuch as there is to be a new crown which is being put together upon the scaffolding below. It is something that requires attention, however, in connection with the prospective use to which the old crown will be put for letting the three lifts down again. There is, of course, the risk of "something going" when the old sheets are put back into their original position, and made to bear the weight of the additional lift, albeit only for a short time. Hence the lowering operation will not be without a particular degree of interest; and we shall hope to witness and record it as the successful completion of a somewhat important operation in gasholder engineering.

Lead Seals for Prepayment Meters.—Mr. Arthur Broadberry has invented a device for the purpose of dispensing with the use of padlocks, or other separate fastening, for prepayment meter cash-boxes, whereby a lead seal may be employed, so that any attempt to open the cash-box may be readily detected.

The Water Supply of Paris.—The new project of law authorizing the carrying out of works for bringing a fresh supply of water to Paris from the sources of the Loing and the Lunain, two small tributaries in the department of the Eure, has lately been adopted by the Chamber of Deputies, though only after a long and exhaustive debate. M. de Selves, the Prefect of the Seine, urged that the work should be put in hand forthwith.

THE ECONOMICAL LIMIT OF LIGHTING APPLIANCES.

The general idea is that a thing may be used until it is worn out; and that the longer it lasts, the better. But this is not true of many things, and especially so (as was ably illustrated by Mr. H. B. Monroe, in a paper read at the recent meeting of the Texas Gas and Electric Association) in the case of incandescent electric lamps, to which class of appliances the author's remarks were especially directed. The conclusion to which we call attention is: "There is a limiting period for all lamps to burn, beyond which, if continued in use, very dim and reduced candle power makes the light far more costly than if the dim lamps had been replaced with new ones." This may be applied, with certain limitations, to all kinds of lighting appliances; and, indeed, it may extend to many other things besides lamps. The present intention is to look at it in connection with gas lighting apparatus. It is evident that the first cost of the burner or lamp, whether supplied *gratis* or purchased as a distinct item by the customer, is an integral part of the cost of the light. Whether it is inclusive or exclusive as regards the quarterly bill, is merely an incidental matter—the practical result is the same. This fact is frequently overlooked; but it is none the less true. The economical limit is primarily the consumer's affair, and is only of interest to the gas company as affecting the popularity and the demand for gas. It is from this point of view that it was approached by Mr. Monroe, who has found that the deterioration of the incandescent electric lamp in the course of usage is so serious as to have a prejudicial effect on the demand for electricity. As an illustration from the case of gas lighting, one may take the statement issued some years ago, in which the first cost of certain kinds of gas-burners is lumped in with the charge for twelve months' gas; and it is shown that the cheapest cost per "candle-hour" may possibly be furnished by a burner which cost the most in the first place—in other words, that a burner priced at half-a-crown may really be cheaper than one at a penny. Gas companies have done a great deal in the way of educating the consumer, who, by reason of ignorance, indifference, or prejudice, is very apt to be blind or misled as to his true interests; and the object sought in what we call "education," is to induce him to properly appreciate such points as that of the "economical limit" now under consideration.

Every lighting appliance may be regarded as a transformer. A regular supply of energy in some form or other is conveyed to it; and the same is absorbed or rendered latent in a practical sense, or, to be strictly accurate, is converted into some other forms of energy. Whether the motive power is electricity, heat, chemical affinity, or other form of energy, the result is the same; and the process of transforming is always attended with loss or waste. Energy cannot be transformed in the same way as a sovereign can be changed for twenty shillings in silver, as the resulting "change" is always considerably less than the twenty shillings. So, while the consumer looks at the actual cost per candle-hour in current coin of the realm, the scientist regards the theoretical economy of the appliances, and measures the same in percentage terms of the energy supplied. The consumer calls the lamp "cheap" or "dear" by comparison with other ways in which his demand for light may be supplied; but the scientist measures its economy in "watts" or in "heat-units" per candle-hour. So we must distinguish between a lamp that is cheap in a commercial sense, and one that is economical from the scientific point of view. The cheapest lamp may possibly depend upon very cheap sources of power, and deal with the same in a prodigal way; while a more costly light may be expensive or complicated, or only capable of dealing with costly forms of energy, though perfect as regards scientific economy. In taking into account lamps applicable to one particular agent, such as gas or electric lamps, and assuming that the conditions of service—*i.e.* steadiness, colour, &c.—are satisfactorily met by each, we may make direct comparisons on the grounds of first cost and efficiency.

Here, however, the question of durability, as indicating something more than mere length of days, comes into prominence. It has been usual to assume that the scientific economy of gas-burners remains constant throughout their practical life, so long as they are clean, in good order, and properly served. A test of the new appliance is therefore tacitly regarded as a fair indication of the average that will obtain over a reasonable period of service. But Mr. Monroe showed that, with certain kinds of lighting appliances—incandescent electric lamps to wit—the scientific economy is a gradually diminishing quantity. Starting with a candle power equivalent to 100, there is at first a slight appreciation; but after that, a steady and continual failing. Taking tests at each 100 hours of usage, in the best example there is a practically regular drop from 100-candle power at starting to 83 candles at 900 hours; and in the worst, there is a rapid fall to 75 candles at the end of 100 hours 60 candles at 200 hours, and 50 candles at 300 hours. When we read that the consumption of power remains practically the same, it is evident that the economy of the lamp, as instanced by a commencing test, is utterly misleading as regards its actual performance. It is all very well to make a test and label the lamp, say, 3 watts per candle-hour; but this calculation is upset altogether by the unknown variable of depreciation, which carries with it a proportionate decrease of economy. In

the cases named, the economy of the good lamp will only have fallen to 3·7 watts per candle-hour at the end of 900 hours, during which it will have averaged 3·4 watts. But the bad lamp will fall to 6 watts in 300 hours, and continue to get less dim the remainder of its life. Therefore to the factor of durability, as ordinarily understood, we must tack on that of average economy. If the cost of the appliance is considerable, as compared with that of the energy used, it will pay to put up with the depreciation for some time. But it usually happens that the first cost is merely a trifling proportion of the whole expense, in which case the "economical limit" is reached at a comparatively early age.

Another point is made evident by these considerations—that the true cost of incandescent electric lamps per candle-hour has been very much understated. It has been usual to ignore the question of depreciation, and to assume that a test taken when the lamp is new and fresh from the workshop gives a fair average of the lighting power and scientific economy throughout its life. And this depreciation is the more serious, because there is no evidence of its existence apart from the failing of the light. Mr. Monroe particularly pointed out that it is entirely distinct from the discolouration or blackening of the inside of the glass that is sometimes observed. In the case of a gas-burner going wrong, there is an irregular-shaped flame, a piece chipped off, an accumulation of dirt or foreign matter, a broken mantle, or other tangible evidence. But here the depreciation is only rendered evident by the photometrical test until it reaches such an extent that the light appears obviously dim; so that where several lamps are in use, a considerable amount of depreciation may occur without attracting attention.

It would be interesting if the line of research followed by Mr. Monroe could be applied to incandescent gas-lamps. There are certain conditions which tend to decrease the scientific economy of the Welsbach burner as it progresses in age—deterioration of the mantle, accumulations of dirt or foreign matter, corrosion or erosion at the burner outlets, &c.—but we do not call to mind any systematic investigation as to the effects of this in ordinary practice. It is not probable, however, that they are so important as is the case with the electric lamp. The new burners have been adopted in general use for a sufficient time; and the depreciation has not attracted any special degree of attention. Yet it would be well to have some information as to the "economical limit" of the incandescent gaslight. Isolated tests on one mantle are not enough; for it is well known that there is a great deal of individuality about the mantles, just as there is with the carbon filaments. The environments of the light when in use, the presence of dust or grit in the air supply, and the existence of vibration or shock, would have some effect. Possibly there is an economic limit with the incandescent mantle, as well as with the carbon filament.

Mr. Monroe turns his attention to the question of the best way of dealing with this difficulty, and unhesitatingly recommends free renewals, and the employment of a special staff for the purpose of "weeding out the dim lights." In this matter, he was well supported in the discussion; the dissentient in the case of small undertakings, admitting that there was no question as to the line of policy to be followed by any concern that could afford to employ outdoor inspectors. This is a case of history repeating itself; as gas companies have before now found it advisable to undertake the renewal or replacement of bad burners. The question is a somewhat delicate one; and it is so apt to lead to unpleasantness between the supplier and the consumer, that many have found it advisable to bear the expense of the renewals themselves rather than to force the consumer in any way, for the average consumer considers himself competent to give a decision that should be final as to the accuracy of his meter, the state of his fittings, and all other matters. He will, in an airy way, order the company to lay a mile or so of main-pipe or a few hundred feet of larger service, for the special improvement of his supply; but if requested to renew his burners at a cost of a few shillings, he takes up a very different position. Not properly understanding his interest in the economical limit question, he is apt to jump to the conclusion that some artfully laid scheme for increasing his quarterly bill is on foot. Gas companies discovered, some forty years ago, that they were blamed for sins that were rightly chargeable to bad burners and fittings; and suppliers of electricity are now finding the same thing.

The matter emphasizes the necessity that the supplier should be allowed to have a voice in the choice of appliances right through to the burner. Where there is competition between gas, oil, and electricity, neither can afford to allow the consumer to continue and persist in the use of cheap but unsuitable burners, and to receive the credit (?) of the unsatisfactory results that unvariably follow. There is one plan that has lately been introduced—viz., the prepayment system combined with hire of fittings—the gas company putting the service, meter, brackets, pendants, and stoves on the premises at their own cost, and including a rent for them in the price of the gas. Apart from other questions, this system certainly possesses the advantage of securing full control over the fittings and burners; thus preventing the use of bad and wasteful appliances. There is something to be said in favour of the customer having a stake in the matter; and he is likely to be more careful and considerate of his own, than of hired property. When the difficulties instanced by Mr. Monroe are experienced, it would appear that the only satisfactory remedy is the adoption of the hire system.

'TIS SIXTY YEARS SINCE.

Of Royal Jubilee literature there is an enormous volume; and one may well be pardoned for hoping essayists and reviewers will soon drop the subject of "'Tis Sixty Years Since," and try to interest their readers in something else. For the time being, however, there is little beyond this to talk about; and we confess to having read with much pleasure a particularly well-written article bearing the title given above, which has the place of honour in the May number of "Blackwood." The writer does not give his name; but he narrates very agreeably his own gossipy reminiscences of what things were like generally in England and Scotland sixty years ago, when he was a child of six, and therefore, as he remarks, just "on the edge of conscious recollection." Our own interest in his story was aroused at the outset by the circumstance that one of the first impressions he retails is the effect produced in his youthful mind by the lighting of Princes Street, Edinburgh. He was setting out on a journey by canal boat from Edinburgh to Glasgow, which was to take the whole of a long day in the winter; and he remembers that "the lamps were still lit along the long line of Princes Street"—a "gold thread," as he said, in the dark of the wintry morning, when he was carried along to the embarkation. He does not say anything as to the lights of Glasgow the following evening, being probably too weary to notice them.

After chatting about the travelling and postal arrangements of the period, the observant veteran reminds his readers that "the age of Victoria, in many ways so full of light, was not within doors and in its domestic centres a bright age when it began. Gas had, indeed, come into the world to light the streets, and more or less the shops, in great thoroughfares; but in our homes the lights were few. The primitive cruse of oil, with its rough wick and smoky flame, at once feeble and wavering, gave a very dim aid to the fire-light on a cottage hearth; and in the homes of middle-class respectability a mild twilight lingered, with deep darkness in every corner. *Dans l'intimité*, when there was no company, a pair of candles, flanked by a snuffer-tray, was considered sufficient for ordinary family purposes." Let us break off here for a moment, to inquire how many of those who read these lines, being under the age of forty, have ever seen a pair of snuffers in use? It is sometimes made a cause of reproof to the younger generation that they do not read Dickens and the other masters of literature of the early Victorian era. But part of the reason for this neglect of writers who sufficiently amused their parents is to be found in the change of circumstances, which prevents the younger race from understanding much of the fun of the older humorists. There is, for example, the familiar instance of the Irish servant, who, being summoned into the parlour to snuff the candles, distinguished himself by elegantly removing the snuff with his moistened finger and thumb, and carefully placing his trophy in the receptacle of the snuffers. It is easy to perceive how a story of this kind would be laughed at by people who were familiar with the elements of the joke; but the same consideration serves to show that it must fall absolutely flat in the absence of these necessary factors. To resume: The writer in "Maga" reminds us that "lamps came slowly, and were troublesome; and when the inventor reached the sober excellence of the moderator, there was a long pause, as if the climax of good lighting had been obtained." So, in point of fact, it had been for the materials in use. But this is a technical consideration which excusably escapes the narrator. He goes on to tell how "the twinkle of wax candles, many of them surrounding a room in pretty clusters, was the ideal of perfect domestic illumination"—and a very good one; "but this was only for gala nights, except in those ineffable houses of the great which we spoke of with bated breath, but did not attempt to emulate." The writer is fully justified in his appreciation of the quality of domestic lighting by clustered candles; and he might have stated with perfect truth that this ideal still holds good. The latest means of interior lighting—the incandescent electric light—is fain to pay to the wax candle the compliment of imitation, with deplorable results. What is more to the point in this connection is the fact that in this matter of beautiful and brilliant domestic lighting, as in so many other respects, what was sixty years ago the prerogative of the wealthy has been brought within the means of the mass of the population. We all admire the effect of candle lighting carried out artistically and upon a sufficient scale, and the expense need be no deterrent to those who will take the trouble of it.

The writer brings out a very striking result of the enforced economy of domestic lighting sixty years ago which is not generally remembered. There was one particular of this deprivation that left its impress upon the mind and also upon the literature of the generations. "The children of the present day must, for example, find it difficult to understand the terror of the children of an elder age for the dark passages along which so many little heroes and heroines in the old story-books made a breathless dart with their hearts in their mouths, not knowing what frightful danger might lurk behind this or that black corner." This reminder awakens long dormant memories in the mind of the reader who, if not able to look back sixty years, has yet known what it meant to pass a childhood in houses in which passage and staircase lighting was as yet an unknown luxury. "We remember well the excuses for

another moment's delay in the drawing-room, which by comparison seemed so bright, or the nursery, in which perhaps one candle on the mantelpiece was an illumination, in comparison with the awful blackness of the passages between." He gives a very natural description of the terrors—not always confined to children—of the dark passages and stairways, which, we may remark, not even the possession of a "dip" or a "rushlight" was competent to dispel. Quite grown people did not always care to look behind them while on the way from one room to another, and never made the transit after dark if they could possibly avoid it. The whole upstair part of a big or small house was in those days left in utter darkness after dusk—a gloom only fitfully broken by the infrequent domestic with an ineffective candle. "There are no dark passages now."

Lucifer matches were introduced about the beginning of the Queen's reign; but like most other novelties, they were objected to by an inappreciative public. Indeed, it might almost be safe to generalize, from the reviewer's observations, that all the good things of the reign were unpopular at first. He confesses that "all the new inventions which have added so greatly to our comfort were received without enthusiam—from the railway on which a cow errant was supposed to be capable of proving a serious embarrassment, to the matches, which had a bad smell. When candles were made which wanted no snuffing, although it was manifestly a great convenience, there were revilings—it being supposed at first that they were not so bright as the old smoky flame!"

The subject of artificial lighting is evidently of particular interest to this reviewer, for he returns to it after discussing steam, electricity, antiseptic surgery, and other triumphs of the reign. He draws the picture of "an early Victorian room, belonging, say, to a member of the professional classes, not rich but comfortable enough, with the two candles on the table, the one weekly newspaper, the anxious look-out for franks, the occasional journey in a stuffy coach or slow canal-boat." This is the house through which "persons passing from one room to another carried a candle, and little children not trusted with such aids flew breathless with beating hearts; every run from the parlour to the nursery being haunted with horror, through the dark passages." The writer tells us a good deal; but he might have told us more without fearing to be wearisome. He does not say a word about the amusements of the town, or rather the lack of them. Where were the public halls, the lecture and reading rooms, the evening classes for the long winter nights—impossible without gas—the summer holiday sports, and excursions? Truly, it was a dim time to which he recalls us; and greatly as he is concerned with the facts of interior lighting, even the reviewer does not rise to the perception of the part played by improved artificial lighting in that social advancement which the last sixty years have witnessed.

The title of the article we have been discussing is borrowed, as the writer is careful to point out, from "Waverley"; and the opinion is hazarded that when Sir Walter Scott wrote these words at the head of his first great romance, he perhaps thought that his country could not in the nature of things see any other such complete alteration in manners and customs as that which he recorded. "We have made no such inherent and fundamental change"—have we not? It is remarked that many of our changes would not have pleased Sir Walter. "He would not have loved a world in which all distinctions tend to grow less and less, where the Scot differs but little from the Englishman, and much picturesque circumstance has been swept ruthlessly away. He would have been deafened by the clamour, hurried off his feet by the speed. Many of our expedients for smoothing life, which also vulgarize it, would have been odious to him; and what such an observer would think of all our glory of railways and telegraphs, who can say?" With regard to at least one of our modern "glories," there is happily no room for doubt. Whatever else Sir Walter might have deplored in modern civilization, he would have warmly welcomed the great popularity of illuminating gas, for was he not himself Chairman of the first Edinburgh Gas Company? This reflection may be left to stand as the last word upon the subject.

NOTES.

The Hygrometric Qualities of Coals.

A somewhat novel investigation has been undertaken by Professor R. C. Carpenter, of the Cornell University, with the object of ascertaining the relative qualities of various coals under the same conditions as regards atmospheric moisture. Two lines of inquiry were opened up. First, a number of samples of different coals were reduced to a uniform physical condition by grinding and powdering, were then thoroughly dried, and afterwards simultaneously exposed to a saturated or nearly saturated atmosphere, for a period of six to eight days. The weight of absorbed moisture was ascertained by taking the difference between first and final weights; this result being checked by thoroughly drying and re-weighing. Secondly, an investigation was made to determine the effect of the size of particles upon the power to absorb moisture; the method of experiment being similar to that of the first inquiry. The system of drying was in all cases the same; the coal being heated to a temperature of from 220° to 240° Fahr., and kept in this condition for one hour. The results, with American coals, indicate a very great difference in the absorptive power of various coals in the same physical state, but show a striking similarity in this respect for coals which are known to possess like qualities and to come from the same deposits. Thus, the samples of anthracite absorbed from just under 5 to slightly over 6 per cent. of the weight of the dry coal; the coking coals from Pennsylvania, from something less than 1 to about 3 per cent.; the Western bituminous coals, from 8 to 14 per cent.; Pocahontas, an amount greater than the anthracites. The first investigation seemed to indicate that independently of the physical condition, different coals vary greatly in their hygrometrical properties, and that with few exceptions the power of absorbing and retaining moisture is in inverse ratio to the calorific value. The effect of the size of the pieces is decided; and as the larger sizes of coal take up the least moisture, it follows that what passes for absorbing power is partly due to capillary action of the surface. In the second investigation, the pieces of coal were made as nearly of equal size as possible, and graded from inch cubes to powder that would pass through a 60-mesh sieve. The results were irregular. In connection with the drying of coals at temperatures above the boiling-point, a number of experiments were made to ascertain whether there was any sensible loss of volatile matter. But, so far as could be determined by repeated trials, there was no such loss from alternate moistening and drying at temperatures below 300° Fahr.

Aluminium for Cooking Utensils.

The recent introduction of aluminium cooking utensils, recommended by the dealers for use with gas-stoves on account of the lightness of the articles, is touched upon in the course of a series of articles upon the metal, published in the "Engineer." It is remarked that the expression "culinary apparatus," taken in its widest sense, will probably be found to cover the largest outlet for commercially pure aluminium, at least until the price of the metal shall have fallen considerably below its present figure. Aluminium is free from the common defects of cast iron, enamelled, copper, and tin cooking utensils; and, by reason of its great thermal conductivity and high specific heat, vessels made of it warm up over the fire quickly and thoroughly without getting scorched or burnt in the process. The writer observes that there is likely to be too great a demand for copper by electricians to permit of its continued use as the material of cooking utensils, to which application it is not particularly well adapted. He thinks that copper should be given up to the electricians, and platinum to the chemists. If the great British public can be persuaded to accept aluminium cooking utensils with their concomitant advantages of lightness, harmlessness, ease of cleaning, &c., and the manufacturing chemist to use it in cases where the employment of copper vessels entails a poisonous or discoloured product, the fortunes of the maker of aluminium will be improved.

Lord Armstrong on the Ether.

Lord Armstrong has published in book form, with plates, the fruits of his many years' investigations of the phenomena of electric movement in air and water. It is nearly 25 years since Sir William Thomson promulgated his conception of matter as "the vortex motion of an everywhere present fluid;" and Lord Armstrong has been able to demonstrate by experimental results of surpassing beauty that, in the domain of electricity, vortex motion in all probability plays a great and hitherto unsuspected part. A current of electricity, on this hypothesis, would consist of a column of electrified vortex rings; polarity being obtained by the mutual attractions of the opposite faces of the rings drawing them into line—one face of each ring corresponding to pressure, and the other to suction. Such an explanation involves the universal presence of a core formed by a return current passing inside the outward flow. For this Lord Armstrong finds strong presumptive confirmation in the well-known fact, demonstrated by him half-a-century ago, that a cotton filament connecting pure water in two wine-glasses placed near to one another, travels towards a positive electrode placed in one glass, while a tube of water encircles it and travels towards the negative electrode placed in the other glass. Similarly, the brilliance of the light of an arc lamp and the crater in the positive carbon are explained by Lord Armstrong as resulting from the impact of a central return negative current upon the centre of the positive carbon. The positive current sweeping outside, bends round under the attraction of the negative carbon, and strikes it obliquely, eroding it in the well-known way. Lord Armstrong cannot put up with the current hypothesis of an ether as the vehicle of energy. He observes that the existence of ether is assumed to supply the supposed need of a subject, and also to fill up gaps in continuity. "But is it easier to conceive a continuity of ether than a continuity of interacting motions? I confess my inability to judge; but we are more familiar with motion than with ether; and we do not seem to gain much by postulating two inscrutables instead of one. The elimination of motion would in the one case mean the extinction of the universe; while in the other there would only remain an impalpable medium which, in the absence of motion, would be scarcely distinguishable from empty space. Endow space with the attributes assigned to ether, and the difference vanishes. Motion would then stand forth as the absolute of matter. But much the same may be said of it, even if the independent existence of ether be conceded."

COMMUNICATED ARTICLES.

A VOLUMETRIC METHOD OF DETERMINING THE AMOUNT OF FREE SULPHUR IN SPENT OXIDE OF IRON.

By H. C. Page, of Leigh, Lancs.

This method I beg to submit to members of the gas industry as an alternative means of making the above estimation in place of the at present recognized and excellent method devised by Mr. Andrew Stephenson, of dissolving out the sulphur with carbon bisulphide. This latter method has, in my opinion, some slight disadvantage owing to the fact that care has to be exercised in preventing the ignition of the vapour arising from the carbon bisulphide used. Moreover, the odour of the carbon bisulphide is rather disagreeable. Again there is sometimes a slight difficulty experienced in packing the cotton wool in the tun-dish tube, so as not to have it so tight as to prevent the free passage of the carbon bisulphide with the sulphur in solution, nor yet so slack as to allow the spent oxide to filter through along with the solvent.

Without further preamble, I will now endeavour to make my method as explicit as possible: Sulphur, when heated along with an oxidizing agent, is coverted first into sulphur dioxide (SO_2), and then into sulphur trioxide (SO_3). If there is any water present—even if water of crystallization—this SO_3 is converted into sulphuric acid (H_2SO_4). In fact, we might call the SO_3 the anhydrous form of sulphuric acid. To effect this conversion in the case we are now considering, I mixed with the spent oxide a quantity of chlorate of potash. On the application of heat, the sulphur present was converted into sulphuric acid; but means had to be found to estimate the amount of sulphuric acid thus produced. To attain this object, I added to the mixture a known quantity of pure sodium carbonate, together with a little common salt—the latter to temper down the action. The free sulphuric acid immediately displaced the carbonic acid from part of the sodium carbonate, and formed sodium sulphate.

An actual experiment was as follows: Weighed out 10 grains of spent oxide, 53 grains of pure sodium carbonate, 70 grains of chlorate of potash, and 70 grains of common salt—all mixed intimately together in fine powder, and fused in an iron crucible at low redness. The fused mixture was then dissolved in hot distilled water, filtered, filtrate coloured with litmus, and titrated with standard sulphuric acid.

The sodium carbonate unacted upon required 70 decems of sulphuric acid; and since 100 decems of standard sulphuric acid would exactly neutralize 53 grains of pure sodium carbonate, the titration showed that an amount of sodium carbonate equivalent to 30 decems of standard sulphuric acid had been acted upon by the sulphuric acid formed by the oxidation of the sulphur in the spent oxide. And since 1 decem of standard sulphuric acid is equivalent to 0·16 grain of sulphur, the amount of sulphur present in the 10-grain sample taken was $0{\cdot}16 \times 30 = 4{\cdot}8$ grains, or the bulk of spent oxide contained 48 per cent. of free sulphur.

RECENT RESEARCH ON ACETYLENE.

By G. E. Brown, A.I.C.

Two recent numbers of the "Berichte," contain three papers by Herr H. G. Söderbaum recounting his experiments with acetylene. Though the entire papers would hardly be suitable for reproduction, a large portion of the author's investigations is of great interest, in view of the important part acetylene seems likely to play in commerce.

After alluding to the work done by Berthèlot, Blochmann, Römer, and others, Herr Söderbaum gives the results of his investigations on the action of acetylene upon salts of copper. Considering the well-known dangerous effects of using alloys containing copper for valves or other fittings with which the gas is liable to come into contact, it is worth noting what light is thrown on the possibility of such danger when the problem is attacked from the purely chemical side. Copper sulphate and copper nitrate were not observed to exhibit any difference in their behaviour towards acetylene. In Herr Söderbaum's experiments, a little of one or other of these salts was dissolved in water, and the solution made ammoniacal by the addition of ammonia of ·96 sp. gr. Through the clear solution obtained, a current of acetylene gas, generated from calcium carbide and purified by bubbling through water and a solution of a lead salt, was passed fairly briskly for from 10 to 15 minutes. The result was that a black flocculent precipitate was thrown down from the liquid. In order to ascertain its composition, the experimenter filtered it off, and dried it in a desiccator. It was found, however, that by this procedure the substance absorbed oxygen from the air. It was therefore dried in a vacuum. The author found that variation in the concentration and temperature of the copper solutions affected the composition of the precipitate. Thus with one gramme of copper sulphate dissolved in 150 c.c. of water, a precipitate was obtained of the following composition:—

	Per Cent.
Copper	71·24
Carbon	27·19
Hydrogen	0·35

Under other circumstances, not precisely defined, a precipitate resulted containing—

	Per Cent.
Copper	66·55
Carbon	26·59
Hydrogen	0·71

If either of these sets of figures be added up, it will be seen that there is a certain percentage of undetermined constituent present. From the absence of other elements, the author concludes that this residue is oxygen.

The character of the precipitate is, of course, liable to slight variation; but, generally speaking, it is a black amorphous powder, insoluble in water and organic solvents. When quite dry, it is decomposed on bringing it into contact with not too dilute nitric acid or with concentrated sulphuric acid—light and sound being produced. In the absence of air, it is not affected by ammonia; but in the presence of air, partial solution takes place. By warming with dilute acids, especially hydrochloric acid, it is quickly decomposed; the copper going completely into solution, but only a very small quantity of acetylene gas being given off. By far the larger proportion of the carbon is separated in combination with water as a black deposit. The weight of deposit in one experiment was about 25 per cent. of the original precipitate of copper acetylide. The chief interest of this compound is with regard to the action of heat upon it. The temperature at which it explodes varies according to the manner and rapidity of heating it. By raising the temperature rapidly, explosion takes place at 50°C.; but with gradual application of heat, the temperature of explosion was found to be 70°C. After long standing in a desiccator, one sample did not explode till the temperature reached 80°C. The explosion of the compound is accompanied by a very sharp report; about one-tenth of a gramme giving the effect of a pistol-shot. Explosion also results from a blow or a shock, as well as when the substance is brought into contact with dilute nitric acid; the reaction in the latter case being somewhat less violent than when heat is applied.

Herr Söderbaum has likewise utilized acetylene in quantitative analysis; and he has shown that in certain circumstances it may be advantageously employed in preference to sulphuretted hydrogen. The particular case investigated was the estimation and separation of copper. Noticing that the filtrate passing from the precipitate of copper acetylide was completely colourless and gave no trace of copper even when tested with potassium ferrocyanide, the author proceeded to ascertain whether this reaction could not be applied to the quantitative estimation of copper, with the result that the following method is recommended:—

The salt which is intended to be analyzed is dissolved in water, diluted moderately (till one gramme is contained in about 150 c.c.), ammonia added, and the whole heated on the water-bath for half an hour. Acetylene gas is then passed into the dark blue solution (which is most conveniently contained in an Erlenmeyer flask) until the liquid is completely saturated. The previous heating of the solution is not absolutely necessary, since the copper separates in the cold; but it has the advantage of accelerating the reaction, and causing the precipitate to separate in a flocculent form, and without any of it adhering tenaciously to the sides of the flask, as is frequently the case when it is precipitated from a cold menstruum. When covered by the saturated solution of acetylene, the precipitate can be allowed to remain in the stoppered flask without undergoing any change; but if left in an open vessel, a portion of the copper is liable, after some time, to go into solution again. After filtration and washing, the acetylide is digested for half an hour with dilute nitric acid. The carbonaceous matter which separates is filtered off, and the filtrate evaporated to complete dryness, and converted into copper oxide by careful ignition. The following results were obtained:—

Salt Taken.	Copper Present.	Copper Found.
$CuSO_4\ 5H_2O$ ..	0·1214 ..	0·1211
,, ..	0·1017 ..	0·1018
$CuCl_2\ 2H_2O$ ..	0·2075 ..	0·2073

The above method possesses the advantage over the employment of sulphuretted hydrogen that the precipitate is easily and quickly obtained, and without especial preponderance of the precipitant; while the errors which are liable to be incurred through oxidation of the precipitated sulphide are entirely avoided. Also, the smell of pure acetylene is not so disagreeable as that of sulphuretted hydrogen.

When this reaction was applied by the author to the separation of copper from zinc, it was found that zinc was one of those metals the presence of which impeded, or, if present in large quantity entirely prevented, the precipitation of the copper acetylide; but that by the addition of sulphuric acid the precipitation of the copper could be made quantitative. The results obtained were as follows:—

Salts Taken.	Copper Present.	Zinc Present.	Copper Found.	Zinc Found.
$CuSO_4\ 5H_2O$ / ZnO	0·0637 ..	0·0692 ..	0·0636 ..	0·0695
$CuSO_4\ 5H_2O$ / ZnO	— ..	0·2623 ..	— ..	0·2629
	Copper Oxide.		Copper Oxide.	
CuO / ZnO	0·0929 ..	0·1733 ..	0·0931 ..	0·1736

TECHNICAL RECORD.

SOCIETE TECHNIQUE DU GAZ EN FRANCE.

The Programme of the Annual Congress.

The Twenty-fourth Annual Congress of the above-named Society will open to-day in the hall of the Society of Civil Engineers, Paris, under the presidency of M. Ph. Delahaye. The morning will, as usual, be devoted to the routine business; and the real work will begin at the afternoon sitting, when the President will deliver his Inaugural Address. The prizes awarded to the authors of the best papers at last year's meeting and to meritorious employees will then be announced; and the day's proceedings will be followed by a banquet at the Hôtel Continental. The whole of the next day will be devoted to the reading and discussion of papers, of which there will be sixteen. In the evening the members will visit the show-rooms of the Paris Gas Company in the Rue du Quatre Septembre. The list of papers is rather shorter than usual. M. Denayrouze will deal with the subject of intense lighting by incandescence; M. Bigeard will furnish a few additional particulars in regard to his trial of Welsbach burners for public lighting at Angers; M. Coze will describe a new arrangement whereby, under suitable conditions, the Welsbach burner may be employed without a chimney; and M. Egraz will explain the Auto-Lux system of lighting. M. Leclaire will offer some suggestions as to the alterations to be made in the retort-houses of the principal gas-works, so as to allow of the introduction of stoking machinery, and the quenching and mechanical removal of coke; the latter subject being also dealt with by M. Rouget, who will show how the arrangement devised by M. Brouwer, which was described and illustrated in the "JOURNAL" early last year, can be applied to the stacking of coke. M. Laurain will describe an articulated scoop for charging retorts; and M. Jouanne will explain how the Kudlicz furnace can be employed for burning breeze, cinders, and other combustible residues. A new appliance for preventing the deposit of naphthalene in mains and in public lamp services will be described by M. Syssoyeff; and M. Bürgkly will introduce a dry isolator for localizing escapes. MM. Maldant, Giroud, Dupoy, and De Billy will describe gas-measuring appliances of various kinds; M. Plouchtchevsky will offer some observations on the position of the tap in a public lamp; and M. Garnier will deal with the use of gas for heating greenhouses.

A STUDY OF INCLINED RETORTS IN EUROPE.

By F. EGNER, of Norfolk (Va.).

[A Paper read at the Meeting of the Western Gas Association, May 19, 1897.]

The value of the method now in successful operation for a number of years in various cities of England and Continental Europe, to charge and discharge gas-retorts by making use of the natural tendency of bodies to fall or slide when placed at an angle greater than that ensuring stability, must be apparent to every gas manager. Having had some experience with the subject—the unfavourable results of which were touched upon in my Presidential Address at our Louisville meeting—and having read a paper on "Inclined Retorts Up to Date" at the St. Louis meeting of the American Gaslight Association,* I now place before you my observations on the same subject, gathered on a recent trip through England, France, Germany, and Austria, and made solely with the object of studying the inclined or sloping retorts where used.

Let us begin at Rheims, where, directed by the genius of M. André Coze, the "slopers" were revived, and for the first time constructed in a manner making them a practical possibility. They have two benches with nine ⏢-shaped retorts each, heated by gas-furnaces on the regenerator principle, and of the Hasse-Didier type. They charge from 352 lbs. to 374 lbs. of coal per retort every four hours; and the charges were seen to be evenly distributed throughout the retorts, and well carbonized. This statement applies also to every installation of the slopers seen, without exception. One of these benches had been in continuous operation for over 1800 days, and the other more than 1000 days, and seemed to be still good. The gas-works are owned by a private Company; but it is expected that the city authorities will acquire the plant in a few years, and hence the Company are not inclined to spend any more money on the works than may be necessary to keep them going. This explains why no more benches with sloping retorts have been erected at Rheims. M. Coze explained that, if he were to build again, he would not construct his benches as these are constructed, but include improvements as applied elsewhere at this time. They still use the heavy, long, bent charging mouthpieces at the upper and back end of the retorts, which is one of the features M. Coze would not now recommend. If one saw only the Rheims benches, one would scarcely prefer the slopers to horizontal retorts with good stoking machinery; as, for instance, the Ross stoker at the Cincinnati Gas-Works.

At the municipal gas-works in the Millerstrasse, Berlin, the slopers have been in operation for a number of years—experimentally, as Herr Bau-Director Reiss said; but, continued the same gentleman, our experiments have been so far satisfactory that we are now about to construct ten benches of slopers at the Millerstrasse and twenty at the Schmarndorf works. There were six benches, with nine retorts each, in action. The retorts were about 10 feet long on the slope; heated with gas-furnaces consuming 16 per cent. of fuel per 100 lbs. of coal carbonized; and coked 418 lbs. of coal per retort every four hours. The charging apparatus was most simple, yet complicated in a sense. It consisted of as many short scoops as there were retorts to be charged each hour. These scoops were suspended, by means of rods and wheels, from a rail track, one side of which passed the charging mouthpieces, and the other side led back to the coaling platform where the scoops were filled before a charge was made.

The raising of the coal had been done in an equally simple way. There was an elevator platform on one side and a water-tank on the other, connected over suitable pulleys by a rope. When the coal-car was to be raised, water was turned into the tank until its greater weight raised the car, and the lowering was accomplished by running off the water out of the tank. Herr Reiss said that this was done to save money during the experimental stage, but that suitable coal-conveying machinery would be applied to the new apparatus.

At the Gitschinerstrasse works of the Imperial Continental Gas Association, I was most cordially received and hospitably treated by Mr. Edward Drory, the Chief Engineer of the several works of the Association in Berlin. Mr. Drory had been for many years located in Vienna (in the Association's service), where he had, through many years of study, brought the slopers to a high state of efficiency. At the time of my visit, Mr. Drory was erecting 26 benches of slopers with nine 15-feet retorts per bench, on his improved Vienna model, for which, in its present perfected state, he insisted he was largely indebted to his former assistant's (Herr Körting's) studies, labour, and inventive spirit. These benches must be ready by October next. Mr. Drory not only showed me all the drawings relating to this new work, but also his estimates of cost, from which it appeared that, per 1000 cubic feet of gas made, the slopers cost less to build than horizontal retorts. As to the cost of manipulation, the stoking-machines—of which he had a number in operation at the time—though far more economical than all manual labour, could not compare by many per cent. with the slopers. And it must not be forgotten that Mr. Drory's experience with the three kinds of retort-house manipulation extends over a period of many years, and is not merely a thing of recent occurrence. For the cost of the three systems as given by Mr. Drory, I would refer you to the published statements in my paper previously mentioned.

Leaving Berlin, Dresden was next visited; and there, through the kindness of Herr Baurath Hasse, the Neustader Gas-Works were inspected in company with the Superintendent of Works, Herr Höffner. I saw there benches of nines which had been upwards of 1000 days in constant operation, but now let down for renewal; while other sets of benches had been, and still were, in operation, for more than 800 days. Much information was obtained at Dresden.

Then Vienna was visited. The English Company's franchise there expires in four years; and the Municipality refused to renew it, and decided to erect works of their own. A similar state of affairs prevails as mentioned concerning Rheims—with this difference only, that the slopers, though from 700 to 800 days in operation, are up to date, and still good. But to show how the slopers are regarded at Vienna, the fact that at the new Municipal Gas-Works these only are to be used, and no horizontal retorts at all, speaks volumes. Herr Hermann, the City Engineer, and the Director in charge of the new Bureau of Gas, exhibited and explained the drawings for the new plant. He stated that he had carefully studied the subject of manual and machine stoking, and gave at some length his reasons for having decided upon using slopers only. There will be 180 benches with nine retorts, 15 feet long, in each.

The ideal works, as a whole, were seen at Cassel. They were erected in 1894, in accordance with plans prepared by Herr Emil Merz, the Engineer and Director of the Municipal Gas Bureau of the city. Herr Merz had the good fortune to have entirely new works to plan, and to execute his own designs He was given all the ground space he wanted, and was not limited in any other particular. He was not obliged to convince a president, who was not a gas engineer, and perhaps knew nothing of the professional aspects of the business, that his (the gas engineer's) plans were really those which ought to be followed. It was understood that he was master of his art, and was trusted to do the best he could; and the result is what may be considered model gas-works. There is no odour of gas perceptible at any part of the works—not even in the purifying-house, unless a box is open; and everything is as safe and conveniently arranged as can be desired. No horizontal retorts are used at these works, and in the building of them from first to last but nine months of time were occupied. Herr Merz describes the inclined retort as the "rational drawing and charging machine, without the aid of machinery."

In like manner I saw the slopers in use at Huddersfield, Brentford, and Salford in England; and I can safely state that it is my opinion that no one who had seen them at work as I have seen them would ever seriously consider the use of horizontal retorts

* See "JOURNAL," Vol. LXVIII., p. 904.

if obliged to rebuild his benches. As stated at the beginning of this paper, in every case the heats were good, and the coal well distributed and coked. Slopers differ mainly in the arrangements for handling coal and charging the retorts. With some of the methods in use, there is absolutely nothing left to the discretion of the labourer who handles the apparatus; and with others, more or less—but in no case much—skill on part of the workman can affect the results. While on the Continent retorts from 10 to 15 feet in length are mostly used, in England those 20 feet long are more commonly employed.

[At the close of the paper, Mr. Egner gave some figures in memorandum of the results secured at Vienna, Salford, and Brentford; and he said he would gladly reply to inquiries on the subject. He also exhibited several photographs of the inclined retort systems at the places named.]

TEXAS GAS AND ELECTRIC LIGHTING ASSOCIATION.

The Third Annual Meeting at San Antonio.

(*Concluded from p.* 1296.)

Last week, in giving an abstract report of the proceedings at the above-named meeting, only passing reference was made to the paper read by Mr. H. L. Monroe, of Dallas, on "Incandescent Lamp Efficiency: Its Importance to Central Stations." Further particulars as to the paper, and the discussion that followed, will be interesting to-day in view of the article on the subject that appears in another column.

The author pointed out that, apart from blackening or discoloration, the incandescent lamp loses candle power from the time it is first used; and the primary characteristics by which the lamp should be judged were its efficiency as a light producer, and its economy in wattsper candle. He exhibited ideal diagrams of a good and a bad lamp respectively. The former showed a steady decrease from 100 to 83 per cent. in candle power in the course of 900 hours' use; and the latter fell to 50 per cent. in the first 300 hours, and after that steadily decreased. He emphasized the fact that, apart from the lighting efficiency, the latter would be called an excellent lamp. With loss of lighting efficiency, the resistance of the filament increased; and it would be practically impossible to burn it out. In comparing lamps, it was necessary to secure the same conditions of voltage and candle power in each case. Lamps of 50 volts had relatively a thicker filament, and were more durable than 100-volt lamps; and therefore it was manifestly unfair to compare low-volt lamps of one make with high-volt lamps of another. For the same reason, high-power lamps were more durable than low-power ones; and an 8 or 10 candle lamp should not be compared with a 32-candle one. Further, voltage and candle power were not enough, as it was even more important that the economy should be equal. A 20-candle power—3·1 watts per candle—114 volt lamp, used at 110 volts, would only be yielding an economy of 3·6 watts per candle. If compared with a 16-candle power, 3·1 watts, 110-volt lamp, the filaments would be under a different degree of incandescence or strain, though giving equal light. Very small differences of efficiency produced great variations in lighting power; and by lowering the efficiency, it was possible to increase the durability. Customers could not tell the difference between a 16 and a 20 candle light by the eye; and a full 16-candle power 50-watt lamp would have an efficiency of 3·1 watts; while if it gave 13-candle power, the efficiency would be really only 3·5 watts. It followed that there was a time when the candle power of a lamp fell to a point beyond which it could not be economically continued in use. A station was operated in the best manner, when it furnished candle power at the lowest cost. A lamp averaging a life of 1000 hours, at an average efficiency of 12-candle power, would cost about 10d. per candle; but if used after that, the average would fall to about 7 candles, the consumption of power remaining practically the same—thus nearly doubling the cost of the light. The history of poorly-paying lamp stations would be found, in almost every case, to be lack of proper attention to lamp renewals and the consequent service of poor, dim light. And yet the cost of the lamp represented less than one-tenth of the total cost of producing the light. It was no use studying efficiency in the generation and distribution of electricity, if the lamp was not properly cared for. The average customer knew nothing of engines, dynamos, and lines; but he was aware if the light was dim.

The author passed on to advocate the granting of free lamp renewals, and the employment of men to inspect and weed out blackened or dim lamps, without waiting for a complaint. If the lamps were charged for, customers objected to change them till they were really burnt out; and to meet this difficulty, some companies renewed dim lights at half the cost of a new lamp, with satisfactory results. In any case, it was a mistake to try to make a profit on the sale of lamps. Lamps were made and used of three different classes—4, 3·6, and 3·1 watts per candle power; and in considering the question of economy, it was necessary to distinguish between low voltage and high voltage, and also between low and high candle power, owing to the relatively larger filaments of low-volt lamps. The tendency was towards high voltages; and low-volt lamps would become obsolete in time. Now 220-volt lamps were pushing their way, though only of 4-watt efficiency. Their performance corresponded closely to 110-volt 3·1-watt lamps; and therefore they required 30 per cent. more power. They cost 25 per cent. more in the first place; and their utility was to be judged by comparing the increased first cost and that of larger engines and dynamos, with the saving in distributing plant secured by their use. The 2½-watt lamps had been talked of for some time; but they were not a commercial success. They could only be used with a low voltage—say, about 50—and it was difficult to regulate such low currents in practice. If the voltage was practically perfect, 3·1-watt lamps could be used; but if the voltage was only fairly regular—say, within 4 per cent.—3·6-watt lamps were preferable. He recommended the highest efficiency, consistent with the degree of regulation. There was no lamp made that could be used with advantage for more than 1000 hours; and the practical limit was about 600 to 800 hours. An accurate record should be kept of the average life, where free renewals were the rule. It was a mistake to blame the lamps when breakage was high. The free use of a portable voltmeter (which was to be recommended in every case), would tell a different tale; and it was noticeable that in cases of high voltage, the new lamps were the first to go. The plan of raising the voltage, with a view of increasing the candle power of the lights, was reprehensible, and sure to result in bad service, as it increased the rate of depreciation. If more light was wanted, it was preferable to use 20 or 24 candle power lamps, instead of 16-candle ones. The author concluded by insisting on the importance of constant voltage.

Mr. Lord, in opening the discussion, drew attention to the importance of the matters dealt with in the paper, and said that in his plant there were six independent circuits, carrying 6 to 10 ampères on each, fitted with Stillwell regulators, so that all could be worked from one machine, and the pressure regulated on each. He secured good regulation, and found the 3·6-watt lamp best suited to 50 volts. The average life was 700 to 750 hours. If a customer used the lamps on a meter, he sold him the first lot of lamps at 1s. 3d. each, or 1s. 0½d. for large quantities; and he supplied renewals *gratis*, if the whole lamp was produced after reasonable usage. He found he could afford to give 600-hour lamps free to meter customers; but the contract customers always provided their own lamps. Mr. Cox advocated selling the current at the lowest possible rate, and leaving the consumer to find his own lamps; and this was after some experience with free renewals. The economy of a lamp was an important point; yet but few stations were furnished with the means of testing it. He also agreed that the voltmeter should be more freely used. Whatever might be the opinion about small stations, he thought there was no question that in large towns, where it paid to keep on a special staff, the central station should find the lamps. Mr. Cushman said that unless the converters were loaded, the regulation could not be perfect on all the circuits. In the case of several circuits worked from one machine, the load would at times be light on some and heavy on others.

Mr. Monroe, in reply, said that with small converters it was not possible to get better than a 4 per cent. regulation; and therefore he advocated large converters. A new automatic regulator had just been introduced, to deal with the variation referred to by the last speaker.

Mr. J. H. Fitzgerald read the last paper, entitled "Odds and Ends," suggested by a perusal of Mr. Holmes's paper, and an irregular discussion followed. Mr. Cox asked for experiences in the use of lignite coal for boilers. He obtained as good results by using 10¾ tons of lignite, costing 9s. per ton, as from 7 tons of equal parts of Cumberland and Alabama coal, which cost 16s. 4d. per ton; but he had to put on an extra fireman. He was thus saving £20 per month. The lignite burnt just like wood, and was best worked with a layer only 4 inches thick in the furnace. Frequent firing was necessary, and some care in other ways. His boiler was rated at 530-horse power; and he actually developed about 450-horse power. Mr. Lord said he used M'Allister slack coal. He had tried lignite, but could not do with it at all. He gathered it was a different kind to that mentioned by Mr. Cox, as it was more like charcoal, and made no clinker. With regard to generator furnaces, he regulated the air supply until all evidence of blue flame in the flues disappeared. The thinner any boiler fire could be worked, the greater the economy. Mr. Eddy had tried almost every variety of lignite in the district, but found it a failure; and stokers sent by the parties who supplied the lignite for the purpose of working it, were unable to do so. Mr. Taylor found Richdale lignite cheaper than any other fuel. It cost him 4s. 9d. per ton, while wood cost 10s. 6d. per cord, M'Allister nuts, 20s. per ton, and screened, 20s. 10d. per ton. Mr. Fuller gave details of a test which showed that lignite was cheaper than coal. Mr. Starr also found lignite cheaper than coal; but he could sometimes get wood cheaper than lignite. Mr. Holmes said that the difficulty in trying new fuels of a different character to those previously in use was to get the firemen to work them properly; they required six months to learn how to work a fuel. Lignite really required not only different handling, but different furnaces to those adapted for coal. Mr. Cashman remarked that lignite contained nearly 30 per cent. of moisture; and therefore it must be fired lightly, as a heavy charge would smother the fire.

Among the contents of the Question Box, was an inquiry as to

the best methods of introducing and maintaining incandescent gas-lamps. The President said he had an inspector whose duty it was to examine and maintain the burners in good order. He undertook to do this at a fixed rate, according to the number of lamps in use—ranging from 1s. 0½d. to 7½d. per lamp per month. A question as to the recently developed oil-fields at Corsicana, Texas, elicited the fact that there are three or four wells raising a total of 60 barrels per day. Several members spoke highly in favour of the oil both for fuel and gas making. Mr. Monroe said that oil at 1s. 2d. per gallon was preferable to coal at 15s. 7d. per ton. Mr. Oliger had understood that three barrels of oil were equal to a ton of coal. It was also remarked that directly one had put down special plant for using the oil, the price was raised.

In the course of the closing business, reference was made to a Gas and Electric Exhibition that had been held in connection with the meeting.

Recognition of Benzene and Benzoline.—According to A. Gawalowski, picric acid dissolves freely in coal-tar benzene, and imparts a deep yellow colour to it; whereas it is very sparingly soluble in, and gives no coloration to, petroleum benzine, or benzoline. Picric acid may be precipitated in crystals from its concentrated solution in coal-tar benzene by the addition of an equal volume of the petroleum product.

The Petroleum Supply of Galicia.—Recent petroleum borings in Galicia have brought about very satisfactory results. The annual production amounts at present to some 4,500,000 barrels. But the Schadentgoer Petroleum Company, who own some of the richest springs, are constructing a large refinery at Oderberg, close to the Prussian frontier, with an annual capacity of 500,000 barrels; and the aggregate annual production of Galicia is expected to shortly reach 6,000,000 barrels.

Carbide of Calcium as an Insecticide and a Fertilizer.—According to a Bernese publication devoted to the questions affecting the technical and commercial value of acetylene, experiments which have been made with calcium carbide have shown it to be a specific against *phylloxera*, for which so many remedies have been tried without effect. It is also stated to be an excellent fertilizer; exercising a powerful influence on the growth and nourishment of plants of all kinds.

The Metric System of Weights and Measures is recommended for adoption by all departments of the United States Government in a Bill now before Congress. It proposes to make the metric system of weights and measures legal in the United States after July 1, 1900, in the transaction of all business requiring the use of weight and measurement, except in completing public land surveys. A short Bill on this subject has been introduced into the House of Commons.

Electrolysis of a Water-Pipe.—The extraordinary spectacle of a fountain of water springing from the top of an electric tramway pole has lately been witnessed in Detroit. When a gang of men were set to work to discover the cause of the phenomenon, they came to a water-pipe which ran beneath the pole. The pipe had been eaten through by electrolysis, and the water burst through, entered the hollow iron trolley pole, and, having nowhere else to go, came out at the top. It is believed that such a demonstration of the necessity of looking out for bad work or accident in the insulation of a trolley line is unique.

The Supply of Natural Gas.—A few years ago, when there was a decided falling off in the supply of natural gas, it was predicted that the new fuel would before long be a thing of the past. The latest report of the Philadelphia Company, who have been the most extensive operators in natural gas, indicates that the supply is holding out unexpectedly well. This report is the thirteenth annual statement made by the Company; and it shows that during the past year they drilled 51 wells, 31 of which were productive of gas. The Company are now operating 924 miles of pipe. The bulk of natural gas supplied last year was 10,857,956,000 cubic feet, all of which was sold by meter.

Remarkable Endurance of a Submerged Iron Pipe.—A recent number of the "Engineering Record" contained an instance of remarkable endurance by a submerged iron pipe. At the foot of one of the streets of New York, near the Harlem River, there is an artesian well with a 2-inch iron pipe lining about 70 feet deep. The well is no longer used as a source of supply; but as its water was always at a temperature of about 50° Fahr., it was determined to use it for cooling purposes, and a drinking water supply was carried down to the bottom of it in a ¾-inch iron pipe inside the 2-inch casing, and returned parallel to itself from a U coupling at the bottom—thus forming a simple loop through which the water circulated and was satisfactorily cooled. After having been in use about five years, the small pipe was removed, and the upper part which had been exposed to the atmosphere was found badly rusted, while the lower 50 feet, which had been constantly immersed in the ground water, was absolutely uncorroded. It was covered with a very thin white deposit or film that was easily brushed off; and this left the metal underneath perfectly bright and clean, with the original wrench-marks, &c., plainly visible. There was no unusual taste, smell, or special appearance of the well water, though it was suggested that it was charged with magnesia.

THE CAUSE OF LUMINOSITY OF HYDROCARBON FLAMES.

At a Meeting of the Manchester Section of the Society of Chemical Industry a short time since, a paper on the above subject was read by Mr. WILFRID IRWIN; and it has since been published in the Society's "Journal." Early last year, the author read before the same section a paper on "The Effect of Heat on the Illuminating Power of Coal Gas, and its Relation to the Theory of Flame,"* in which he raised what appeared to him to be vital objections to the acetylene theory of luminosity put forward by Professor Lewes. To this Professor Lewes replied in a paper on "The Development of Light from Gas-Flames," prepared by him in connection with the Gas Industries Exhibition held in New York a few months ago (*ante*, p. 406). Mr. Irwin's paper is as follows:—

During the present century, several theories relating to the luminosity of gas and hydrocarbon flames have been put forward. The earliest assumed that, when a hydrocarbon was burnt, the oxygen of the air united with the hydrogen of the hydrocarbon, leaving solid particles of carbon at a temperature sufficiently high to account for the luminosity. This assumption was shown to be erroneous, from the fact that, when hydrocarbons are exploded with oxygen, the latter always combines with the carbon first, and if there should be an insufficiency of oxygen, free hydrogen always is left.

The next is the theory of Frankland—that luminosity is due to dense but transparent hydrocarbon vapours radiating light at a high temperature. The experiments mentioned in my last paper, and to be alluded to presently, tell against this theory. The theory that luminosity is due to the decomposition of dense hydrocarbon vapours—the carbon separating out in a solid form for an instant, and, owing to the high temperature, emitting light—fails to account for the whole of the light; as I have shown that hydrogen and smoke raised to a temperature higher than that of the hydrocarbon flame emits very little light. Then there is Professor Lewes's acetylene theory, according to which the hydrocarbons in the flame are decomposed, or in the case of light carburetted hydrogen (CH_4) condensed, to form acetylene (C_2H_2) which in its turn decomposes into carbon and hydrogen, the heat of decomposition raising the carbon liberated to a high temperature—acetylene being an endothermic body. Professor Lewes has shown that acetylene will, when pure, decompose, with evolution of light, at 800° C.—the temperature being thereby raised to 1000° C.; also that, when mixed with hydrogen, a similar decomposition occurs, though at a higher temperature. He has found that the gas at the top of the non-luminous part of the flame contains far more acetylene than when it leaves the burner, owing to the decomposition of benzene and other hydrocarbons in the gas.

When Professor Lewes first laid this theory before the chemical world, I must say that it appeared to me the most rational explanation of the cause of luminosity; for all experiments which I have made point to the fact—Frankland's opinion notwithstanding—that solid particles of carbon are necessary to the production of a bright luminous hydrocarbon flame. But I have shown that smoke and hydrogen heated to 1400° C. (a temperature above that at which luminosity commences) emit very little light compared with that from a gas-flame. I have also shown that in a 20-candle gas flame, burning for one hour, not more than 2·4 grammes of carbon have been actually engaged in emitting light during the whole of the time. Certainly, at any given period, not more than 0·0001 gramme of carbon is so employed.

This extraordinary brilliancy is altogether out of comparison with anything obtainable from mere heated smoke; and the acetylene theory has the merit of offering another explanation for it. But there are several objections to it, alluded to in my last paper, which Professor Lewes does not answer to my satisfaction. I have shown that benzene is a better enricher than acetylene; that xylene is a better enricher than benzene; and that naphthalene is a better enricher than xylene.

Given that the acetylene theory is the correct one, one would naturally suppose that the above comparisons would be reversed. But Professor Lewes says that the reason benzene is a better enricher than acetylene is because less of it is unchanged on its way up the flame, and that decomposition takes place just before the resultant acetylene is required for splitting up into its elements with the emission of light. On the other hand, he says acetylene polymerizes to benzene, &c.; but he does not show what harm this can do when such bodies are so easily split up again into acetylene just at the point they are required to do so. Were it not that he assumes that benzene has changed definitely into acetylene to such an extent as to be estimated by analysis before the decomposition of the latter, I should suppose, assuming his theory to be correct, its greater enriching power to be due to its power of yielding three molecules of acetylene, all close to one another, and therefore more concentrated, and consequently able to decompose at a lower temperature than would otherwise have been the case.

If acetylene polymerizes so readily, as Professor Lewes assumes, and does not return to its original form, how does he know that it is really acetylene that he is dealing with when he sees it decompose in glass tubes heated to 800° C.? I showed

* See "JOURNAL," Vol. LXVII., p. 563.

that, passing gas through a heated tube, the illuminating power disappeared when the temperature reached 850° to 900° C., but without production of smoke, and that as the temperature increased to 1400° C. smoke was formed; but, on looking down the tube, neither at 850° nor at the higher temperature of more complete decomposition of the gas, was any glow visible.

This last observation Professor Lewes, in his summary of my paper, omits altogether; and he charges me with misunderstanding his theory, because I make no reference to what is going on inside the tube. Professor Lewes says that decomposition with production of luminosity is going on inside the heated tube; but this is what I could never discover. This leads me to my second objection to his theory: How is it that, when passed through a heated tube, coal gas loses its luminosity without any luminous glow in the tube being produced?

My third objection to his theory is that in a feebly-luminous flame, formed by burning acetylene and hydrogen, stratification occurs, as in other feebly-luminous hydrocarbon flames—showing, I think, that at least two different reactions, occurring at different temperatures, are taking place. Professor Lewes answers this by assuming that reactions take place which are very unlikely to occur, and which stultify other conclusions he has arrived at in his experiments on the action of heat on mixtures of acetylene and hydrogen.

The following experiment, which I have lately made, will be of interest in demonstrating my own latest ideas on luminosity: A horizontal iron tube, 1 inch in width and 4 feet long, corked at either end, was provided. By a small pipe just passing through one of the corks, a stream of coal gas was admitted, while the temperature of the middle of the tube was gradually raised, by means of a furnace, until the gas issuing from a pipe through the other cork had lost its illuminating power. This latter cork was then withdrawn, and the interior of the tube was examined from that end while the gas was passing. All that could be seen was that the pipe was red hot where it had been heated; and neither smoke nor glow of any kind could be detected. The temperature was now raised almost to the melting-point of wrought iron, and still no glow was discernible, though smoke began to form, owing to complete decomposition of the hydrocarbons. Next, by means of a small pipe reaching the heated part of the iron tube, a jet of air was introduced, when immediately there appeared round the end of the jet a very bright glow, which attained its greatest degree of brightness when smoke ceased to be emitted from the open end.

This experiment shows that the presence not only of heat but of air is necessary to the formation of a luminous flame—firstly, in order to decompose the molecules of benzene, &c., before they can be all changed into acetylene; secondly, to combine with the freshly-liberated carbon, to form carbon monoxide, with production of light.

My theory of the cause of luminosity, then, is as follows: The hydrocarbons are first condensed, to form bodies such as benzene, containing in their molecules carbon atoms in combination with very few hydrogen atoms. That in this form they are attacked by oxygen in the lower part of the luminous band of the flame, and split up, yielding carbon monoxide, free carbon, and light carburetted hydrogen (CH_4), which latter passes to above what is the non-luminous band in feebly-luminous flames, where the heat is sufficient to again condense it as aforesaid. That the free carbon, on being liberated, combines with more oxygen to form carbonic oxide, and in this reaction emits the intense light which is characteristic of the flame.

I have shown that the carbon, to possess this light-giving power, must have been recently precipitated in the flame; and if any material time elapses between the precipitation and combination with oxygen, very little luminosity is produced.

AIRD'S "EXPRESS" LOCK JOINT.

All who have had to supervise pipe-laying operations will appreciate the value of a simple contrivance which dispenses with the necessity for screws or bolts of any kind, and enables two lengths of pipe to be instantaneously coupled or uncoupled by any unskilled person. These advantages are claimed for

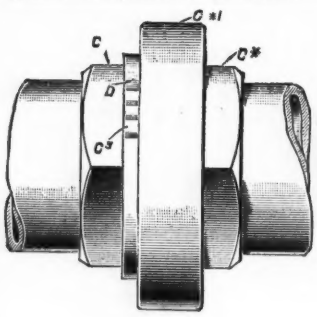


FIG. 1.

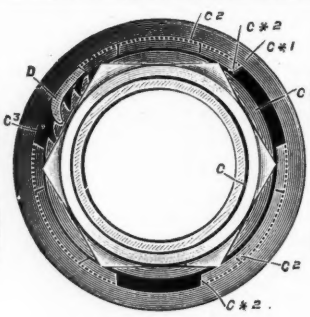


FIG. 2.

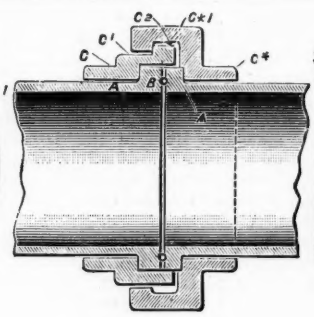


FIG. 3.

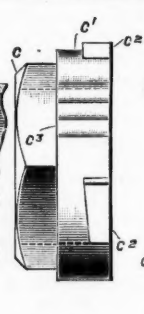


FIG. 4.

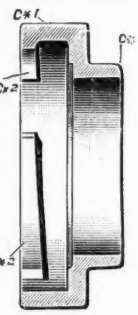


FIG. 5.

the "Express" lock joint invented by Mr. Joseph Aird, of the Wellington Tube Works, Great Bridge, Staffordshire, which, combined with his "Doubly-Secure" joint, is shown in the accompanying illustrations applied to his well-known lap-welded wrought-iron or steel tubes. Fig. 1 is a front, and fig. 2 an end elevation; fig. 3 is a sectional view; fig. 4 an elevation of the male collar; and fig. 5, the section of the female collar. The invention is applied in the following manner: A (fig. 3) are the flanges on the tubes; B is a packing-ring filling in the grooves in the flanges; C C* are two loose clamping-collars, which bear against the flanges; and C^1C^{*1} are overlapping flanges upon the collars C C* which cover the joint, and prevent the blowing out of the packing. Instead of perforating the collars for bolts, as in the old arrangement, the collar C is provided with inclined or wedge-shaped projections C^2, and the other collar C* is formed with co-acting inclines or clips C^{*2}, which engage the inclines C^2, while the back of each collar is shaped like a nut to receive a spanner, by the aid of which the collar may be turned, when the inclines C^2C^{*2} will force the two lengths of tube powerfully together, thereby making a perfectly tight joint. The parts are locked against shifting, even when subjected to severe vibration, by a wedge-shaped dog D which engages a rack C^3 on the collar C.

ESTIMATING FREE NITROGEN IN PURIFIED COAL GAS.

Notwithstanding the well-known fact that nitrogen has a marked deteriorating effect on the illuminating power of coal gas, no simple or direct method of determining the nitrogen in a gaseous mixture has hitherto been elaborated. The method of estimating nitrogen as the residual gas from a number of other determinations is open to serious objection, as the errors of all the prior determinations affect the result. Moreover, the volume of gas on which such a determination is made is usually too small to give an accurate figure for the nitrogen. These considerations impelled M. G. Arth to devise an apparatus for the direct estimation of the free nitrogen in illuminating gas. He has described his apparatus and method in a recent number of the "Bulletin de la Société Chimique de Paris."

The quantity of cyanogen in purified coal gas is so small that its effect on the determination of free nitrogen may be neglected, and traces of ammonia and other basic nitrogenous compounds may be first removed from the gas by means of dilute sulphuric acid. The gas so purified is admitted to the apparatus. The latter has two superimposed bulbs, each of a capacity of 500 c.c. from a mark on the constriction between them to a mark on the terminal constrictions. The zero mark is on the lower constriction; and below this is a small bulb of about 20 c.c. capacity, terminating below in a tube, with a stopcock, connected by flexible tubing to a small reservoir, by moving which the level of the water, or the pressure within the apparatus, may be varied. The reservoir and bulbs contain coloured water. The mouth of the upper bulb is provided with a caoutchouc plug with two perforations, one of which receives a tube attached to a pressure-gauge graduated in half-centimetres, and charged with coloured water, and the other of which receives the end of a glass tube that leads downwards to a three-way cock. One position of this cock opens a way downwards to a tube with two branches, by one of which the gas for analysis is admitted to the apparatus, and by the other of which (sealed in water) gas may be expelled therefrom. The other position of the cock opens a horizontal way, leading past a pinch-cock to a washing-flask in which the tube is sealed to a depth of 1 cm. in pure concentrated sulphuric acid. Between the pinch-cock and the washing-flask is an arm, on which is a three-way cock, the horizontal way of which leads to a tube packed with manganese carbonate, and reposing on a furnace by which the carbonate is heated in order that it may evolve carbonic acid as required. The three-way cock on this arm in another position, allows the carbonic acid to escape through a mercury seal to the air when it is not required to enter the apparatus. The outlet of the sulphuric acid washing-flask leads to a hard glass tube reposing in a gas-furnace. This tube is 85 to 90 cm. long. Its anterior portion is packed for about

55 cm. with black oxide of copper; and this is followed by a coil of sheet copper occupying 15 cm. The end of the combustion tube is bent slightly downwards, and connected to a measuring burette containing a strong solution of caustic potash. A good form of burette for the purpose is Dupré's, as used for the analysis of nitrogenous substances.

The coil of copper is withdrawn from the combustion tube while the copper oxide is heated. Then the air between the gas-inlet arm and the combustion tube is expelled, before the latter is attached, by a stream of the gas to be tested; and the pinch-cock is then closed. Carbonic acid is next generated and passed through the tube to the junction with the copper oxide combustion tube. The connection with the latter is then made, and the air is expelled therefrom by carbonic acid. The copper coil is then introduced, and the burners beneath it are lighted; and a few minutes later connection is made with the measuring burette. The bulbs are in the meantime filled with the gas; and the liquid in the gauge is driven to and fro, to expel air and replace it with gas. The bulbs are emptied and refilled twice; and the gas contained in them may then be considered to be free from air. The gas is admitted and expelled from the bulbs by lowering and raising the water reservoir connected to the lower tubulure. The enclosed gas is forced up to the zero mark; and the connection with the water reservoir is then closed. A few bubbles of gas are allowed to escape by manipulating the three-way cock, until the gauge shows the pressure desired. It has been found convenient to work at a pressure of 13·6 cm. of water, which is equivalent to 10 mm. of mercury. The gas, is therefore, under atmospheric pressure, *plus* 10 mm. of mercury.

The bulbs are surrounded by a water-jacket; and the temperature of the water is observed. The measurement having been made, the water reservoir is slightly raised; and the stopcock between it and the bulbs is again opened. The stream of carbonic acid is diverted, and made to pass through the mercury seal. The pinch-cock is opened slightly, so that the gas passes through the combustion tube—now at a high temperature—at the rate of a litre in about 65 minutes. A pressure of 4 to 5 cm. is maintained during the combustion. If the amount of nitrogen disengaged is considerable, the operation is stopped when 500 c.c. of gas have been used; but otherwise 1000 c.c. are consumed. When the 500 c.c., or 1000 c.c. as the case may be, have nearly been burnt, the stream is checked by means of the screw-clip, and the pressure is slightly increased. When the desired volume has just passed, the stopcock on the tube leading to the water reservoir is again closed, and the gas is allowed to go forward until the gauge shows the pressure at which the former measurement was made. The pinch-cock is then closed. Carbonic acid gas is next passed through the combustion tube, to displace the gas therein. The temperature and barometric pressure are again read; and the mean between the initial and final readings is taken. It is assumed that variation of temperature or pressure during the test was uniform. The nitrogen collected in the burette is measured after the potash solution has been washed out by water. The volume is then calculated to a percentage of the dry gas under standard conditions of temperature and pressure.

By this method, M. Arth found about 1 per cent. of nitrogen in the gas from the Nancy works. The extreme values found were 0·87 and 1·28 per cent. It may be added that the only parts of his apparatus not found in a fairly well equipped laboratory are the superimposed bulbs calibrated to 500 c.c. each; and these could be readily obtained from a glass worker.

Bavarian Association of Gas and Water Engineers.—The twelfth annual meeting of this Association, which now numbers 103 members and associates, was held on the 29th of April at Bayreuth, under the Presidency of Dr. E. Schilling, of Munich. Among the papers read at the meeting were the following: "The Water Supply of Bayreuth," by Herr Schlee; "Extensions at the Augsburg Gas-Works," by Herr Horn; "Heating by Gas of Cars used for the Transport of Beer," by Herr Messinger; and "Acetylene," by Herr Trendel. Next year's meeting will be held at Ansbach.

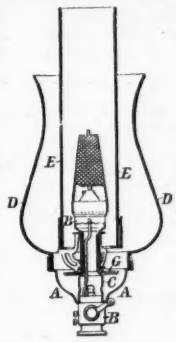
German Association of Gas and Water Engineers.—The annual general meeting of this Association, which takes place, as previously announced in the "JOURNAL," from to-day to Saturday, at Leipsic, will open with a reception this evening. To-morrow the proceedings will begin with the Presidential Address of Herr L. Körting, of Hanover. Beyond the formal business, the following reports and papers will be received: "On the Lighting of Leipsic," by Herr G. Wunder, of that city; the report of a Commission on "Settings of Inclined Retorts," presented by Herr Reissner, of Berlin; "Inclined Retorts and Machine Stokers," by Herr E. Körting, of Vienna; the report of a Commission on "Photometry," presented by Herr A. Thomas, of Zittau; "A Retrospect on Photometry," by Dr. H. Krüss, of Hamburg; "Appliances for the Automatic Ignition of Gas-Burners," by Herr H. Drehschmidt, of Berlin; "On the Incandescent Gas-Light and Acetylene," by Dr. Bunte, of Carlsruhe; and reports of Commissions on "Heating by Gas," and on "Gas-Meters." Some papers on water supply, chiefly of local importance, will also be read. The meetings will take place in the Theatre of the Saxony-Thuringian Industrial Exhibition, and will conclude with festivities and an excursion.

REGISTER OF PATENTS.

Bunsen and Incandescent Gas-Burners.—Catherwood, A. H., of Bermondsey, S.E. No. 11,106; May 21, 1896.

This invention relates to bunsen burners, and to lamps in which such burners are used for heating to incandescence refractory caps or mantles—one important feature being a provision for the heating of the air supplied to the burner to mix with the gas therein, and for the protection of the flame against the effects of draughts or currents of air other than those due to the action of the flame.

The casing of the burner A is made with an opening at its lower end, so that it can be fitted over a part of the burner B, and can then be secured in place by screwing on the air-tube C. The casing A is formed with a gallery at its upper end for supporting the globe D of the lamp; but no perforations are formed in the casing for the admission of air. The air which enters the holes in the tube C to mix with the gas before combustion, and also that which enters the aperture at the lower end of the lamp-chimney E for the purpose of supporting combustion, shall first pass down between the globe D and the chimney E. The air thus supplied will therefore have its temperature raised more or less on its way to the burner. Moreover, the globe D and the casing A together form a chamber in which the whole of the burner down to a point beneath the air-holes is enclosed; and therefore these holes, and the aperture at the lower end of the chimney, are protected against transverse draughts or air-currents. An annular space is left between the casing A and the "lighting-back" plate or disc G, of sufficient area to ensure an ample supply of air to the burner.



According to another part of the invention, the patentee proposes to combine with the other portions of the lamp, a device for nearly closing the space between the burner and the chimney at the lower end of the latter, as he claims to have discovered that, by almost cutting off the supply of air to this space in incandescent lamps, and thus causing more air to be drawn through the burner, not only is the intensity of the light emitted by the mantle materially increased and the light protected against currents of air, which cause the light to flicker or even to momentarily almost disappear, but the consumption of gas is diminished. He points out that he does not claim generally, or irrespectively of his improvements as described, the construction of a gas-lamp in such a manner that the air supplied to the flame must first pass down between the lamp-chimney and a globe surrounding it and closed at its lower end, as he is aware that it has already been proposed to so construct a lamp provided with an ordinary argand gas-burner. He also knows that it has been proposed to partially protect incandescent gas-lamps against the effects of transverse currents of air at the lower end of the chimney, and also at the air-admission holes of the bunsen burner; but he is not aware that it has ever before been proposed to enclose a bunsen or atmospheric burner in an imperforate casing, in such a manner that the entire supply of air to the burner must first pass down within a space surrounding the flame as described, so that all the air that mixes with the gas in the burner, as well as that supplied to the flame for promoting combustion, will be previously heated.

Carburetting Apparatus.—Héreng, P., of Brussels. No. 12,109; June 3, 1896.

In this arrangement, the reservoir forming the carburettor is surmounted by a lid, furnished with a tubulure, having a screw-threaded capsule for the introduction of the carburetting liquid, with a tubulure having an outlet-tap for the carburetted gas, and with an opening for the introduction of a pipe for the passage of the gas. This last-named pipe plunges to near the bottom of the reservoir, and is terminated by a "recipient," perforated in all its walls. The apparatus is filled through the tubulure with "any substance rich in carbon." Hydrogen or ordinary coal gas, on being conveyed to the apparatus, meets with the carburetting body—descending to the recipient, and escaping into the reservoir, where it passes through the whole quantity of the carburetting body before finding an exit by way of the tubulure.

Treating Gas for Illuminating and Heating Purposes.—Arter, A., of Hammersmith, W. No. 12,430; June 6, 1896.

The inventor proposes, after passing the gas through the meter, to heat same before it goes to the burners, so that, "should any watery vapour be carried by the gas, it is at once dispersed," and at the same time "the gas being expanded or rarefied through the action of the heat renders it more economical in use." He suggests forming a jacketed vessel, to be placed over a gas-jet or other source of heat; and to connect to it the supply-pipe from the meter, and also a pipe for conveying the treated gas to the burners. The end portion of this last-mentioned pipe may be coiled within the vessel, or arranged in any other manner so as to obtain a large heating surface.

Treating Acetylene prior to Combustion.—Thorp, T., of Whitefield, and Marsh, T. G., of Manchester. No. 12,942; June 12, 1896.

The patentees' chief improvement consists in a method of diluting acetylene with air before combustion. The gas is produced in suitable apparatus, and preferably stored in a holder at a considerable pressure—say, about 6 inches of water. They then discharge this high-pressure acetylene through the nozzle of an injector, either into the pipes supplying the burners or into a second holder at a low pressure—say, of 1 inch of water. An induced current of the diluent (which may be atmospheric air or other gas) is thus carried along with the acetylene into the pipes or holder; the proportions of the mixture being regulated by adjusting the inlet-orifice of the diluent or the pressure of the acetylene passing into the injector.

Preferably they employ a low-pressure gasholder to supply the diluted acetylene or mixture of gases to the burners; and a further improvement consists in the arrangement of devices for controlling the operation of

the injector, so as to effect the mixture in the manner described, and thus regulate the supply of diluted acetylene to the holder according to the consumption of the same by the burners. Preferably a tumbler-device is adopted for opening and closing a valve on the high-pressure main leading from the high-pressure gasholder to the injector; the levers of the tumbler being actuated by the rising and falling of the second or low-pressure holder. When the diluted gas is used from this second holder, while the injector is not in action, the holder will necessarily descend. In doing so, it is made to actuate one of the tumbler-levers or their equivalents; and when the weight or spring lever has passed the dead-centre, the tumbler will be carried forward in the usual way, and actuate the opening mechanism of the valve. The injector will then immediately commence to act; and the holder becomes filled with the mixture. As this takes place and the holder rises, the other lever (or its equivalent) of the tumbler mechanism is engaged by the holder; and the tumbler is carried backwards until the dead-centre is again passed, when the reverse action takes place, and the valve is closed again.

In the case of a gas-works supplying acetylene gas to a district, it is obvious (says the patentees) that the gas may be supplied at a high pressure as indicated from the storage holder, and the dilution be effected in the manner described, at or near to the point of consumption, in which case much smaller mains will be sufficient; or the gas may be diluted at the works from the high-pressure into a low-pressure holder.

Incandescing Media for Lighting Purposes.—Langhans, R., of Berlin. No. 14,845; July 4, 1896.

In this incandescing body, "vanadiniferous zirconia" is made use of as an illuminant. The patentee points out that zirconia—*i.e.*, the oxide of the earth metal zirconium—is subject to sintering or fritting when exposed to the heat of a bunsen flame; its light-emitting capacity being in consequence rapidly reduced. Moreover, this earth has but a weak illuminating power as compared with incandescing compositions prepared with the so-called "rare" earths. He claims to have found that both the refractive and the light-emitting capacities of zirconia are largely increased by combining it with a small percentage of vanadium pentoxide (V_2O_5). When zirconia is intimately mixed with some tenths of a per cent. of vanadium pentoxide, and the mixture calcined in a bunsen flame, it finally emits a brilliant white light. When zirconia is combined with a larger proportion of vanadium pentoxide—say, 1 per cent.—a yellowish light of great power is emitted; but when the proportion of vanadium pentoxide is still more increased—say, up to 2 per cent.—the light emitted is of an orange tint, and of less power. In all these cases, the incandescing compound does not, however, manifest the slightest tendency to sintering or fritting; and, when cooled down, the mass shows a characteristic brown-yellowish coloration.

Concluding his specification, the patentee says: "In the manufacture of the improved zirconia incandescing media, I may proceed in any of the known ways. For instance, I may impregnate zirconia with an aqueous solution of vanadium pentoxide, or of a vanadyle salt. (It is known to chemists that vanadyle salts are formed by dissolving vanadium pentoxide in an acid; and that, upon being subjected to calcination, such salts are reconverted to vanadium pentoxide.) The required bodies, formed from the paste or mass thus produced, are calcined in the bunsen flame until they radiate light. Or I may first form the body from zirconia, and then impregnate it with the watery vanadiniferous solution. Or I may dissolve a zirconia salt—for instance, zirconium nitrate—in an aqueous solution of vanadium pentoxide or of a vanadyle salt, and impregnate a fabric or other fibrous foundation with the solution; the impregnated fabric or body being then dried, and finally calcined. Or I may evaporate the vanadiniferous zirconia solution to dryness, form the residue into the shape desired, and calcine the body thus obtained. Or I may produce the zirconia body by means of electrolysis, as described in patent No. 22,396, of 1893, impregnate it with an aqueous solution of vanadium pentoxide or of a vanadyle salt, and calcine the impregnated body after drying it. The watery solution of vanadium pentoxide is made use of when incandescing media for white light are to be produced; while the aqueous solution of a vanadyle salt is employed for yellow or orange light. For white light, I prefer to use the two ingredients in the proportion of 99·6 of zirconia to 0·4 of vanadium pentoxide. The bath may be prepared by dissolving in 27 grammes of water so much vanadium pentoxide that a saturated solution is obtained, and dissolving in the latter 25 grammes of crystallized zirconium nitrate."

Generating Acetylene Gas.—Brewer, E. G.; a communication from the Gesellschaft für Acetylen-Gaslicht, of Bâle, Switzerland. No. 7744; March 25, 1897.

This acetylene gas apparatus consists of a generator having a removable bottom, and provided with a safety-valve and pressure-gauge. It is surrounded by a cooling water-vessel, a gasholder, and a vessel designed to receive the water necessary for generating the gas. These vessels are disconnectably connected with each other by pipes; the arrangement being such that the pipe which is designed to convey the water into the generator is provided with a five-way cock, which allows the air or acetylene contained in, or produced in, the generator to pass above the water which is to be led into the generator, for the purpose of introducing only a gradual supply of water into the generator. Consequently sufficient cooling action is ensured in the generator; and the gas can be discharged from the generator before the residue remaining in it after an operation is discharged.

APPLICATIONS FOR LETTERS PATENT.

13,438.—Masterman, C. E., "Supporting incandescent mantles." June 1.

13,469.—Stubbs, S. H., "Separating and ejecting the water of condensation and suspended impurities from steam, vapour, or gas." June 1.

13,496.—Mitchell, F. A., "Acetylene gas generators." June 1.

13,516.—Dobbs, A. E., "Water-meters." June 1.

13,517.—Westinghouse, G., and Rudd, E., "Gas-engines." June 1.

13,547.—Lake, H. H., "Coin-freed gas-meters." A communication from L. P. V. Madsen. June 1.

13,643.—Walton, W. H., "Drying-box and safety percolator, for use with acetylene or other gas, to prevent the possibility of 'flashing back.'" June 3.

13,665.—Young, W., and Fyfe, J., "Retorts for the destructive distillation of shale." June 3.

13,667.—Whalley, D., Hacking, J., and the Ideal Gas Company, Ltd., "Acetylene gas plant." June 3.

13,671.—Smith, F. H., "Acetylene gas generator." June 3.

13,767.—Small, F., and Clarke, T., "Gas taps or cocks." June 4.

13,777.—Taylor, W. F., "Oil or gas engines." June 4.

13,788.—Crowther, J., and Lamb, G., "Draught baffler and ventilator for incandescent lamps or street-lamps." June 4.

13,796.—Weiskirchen, E., "Gas-meters." June 4.

13,798.—Bromhead, S. S., "Generators for acetylene gas." A communication from J. Peyré. June 4.

13,844.—Aird, J., and Taylor, J., and Sons, "Ignition tubes for firing charges in gas-engines." June 5.

13,847.—Warry, J., and Arculus, G. N. & E. A., "Globes, shades, &c., for lighting purposes." June 5.

13,899.—Langhans, R., "Incandescing media for lighting purposes." June 5.

The Accident to the Rope-Guided Holder at Middlesbrough.—After considerable discussion, the Middlesbrough Town Council last Tuesday confirmed a minute of the Gas Committee to the effect that Messrs. Ashmore, Benson, Pease, and Co. be asked to make a formal offer on the lines indicated in Mr. Lloyd Pease's letter to Alderman Hugh Bell on March 4 (*ante*, p. 606), and that, on receipt of the offer, permission to inspect the holder be granted, subject to this being done in the presence of the Gas Engineer, Mr. David Terrace.

Gas for "Jubilee" Celebrations.—Intimations have reached us from various quarters of the intention of local authorities to supply gas gratis, or on greatly reduced terms, for the illuminations on the occasion of the "Diamond Jubilee" of Her Majesty, to be celebrated on the 22nd inst. Among those recently to hand are from Dorking and Tottenham, where the Gas Companies will supply all gas used on that day free; Middleton, where the Town Council will supply it free up till midnight; Rochdale, where the charge will be 1d. per hour for 20 jets; and Widnes, where a special price of 1s. per 1000 cubic feet will be charged all the week. The Hindley District Council will allow a supply of gas free, subject to the fittings being approved by the Gas Manager.

The Oil-Main at Winchester.—As already reported in the "Journal" (*ante*, p. 1071), Mr. Macmorran, Q.C., has advised the Winchester Town Council that the Gas Company had no right, in his opinion, to break up the roads and lay down an oil-main from the railway station to the gas-works, because the Act did not provide for the construction of such a main. The Town Council, on the reception of this opinion, called upon the Company to come to terms on the matter. Mr. C. Wooldridge, the Company's Secretary, has replied that the Directors do not propose to take any steps in the matter. They wish him to point out that their desire is, as far as possible, and compatible with their duties to the Company, to please the Corporation; but that it must be palpable, if the Company are not to take advantage of the improvements in the manufacture of gas as they arise, the public cannot have improvements in lighting or reduction in cost. As a result of this reply, the Town Council have passed a resolution authorizing their Clerk to take steps to obtain an injunction, or to institute such other proceedings against the Company as he may be advised by Counsel.

Heywood Corporation Water-Works Accounts.—Mr. James Diggle the Engineer and Manager of the Heywood Corporation Water-Works, has issued his annual report. It shows there has been an expenditure of £2660 on new mains, and that a further sum has been spent on the purchase of plant and materials required for the Naden higher reservoir new works. The total number of consumers is now 12,815, and of meters 376—an increase respectively of 228 and 5 during the year. The receipts for water for domestic purposes show an increase of £408, and water sold per meter an advance of £314, which, together with a further reduction of £159 in the amount of allowances for discounts, empty property, &c., make a total increase of £881 in the income for water over the previous year. The favourable opinion with regard to the finances of the undertaking which Mr. Diggle ventured to express in his report for 1891, has been more than borne out by the facts. The income during the last six years (1891-7) has increased by £3766; making a total increased annual income of £5314 in eleven years. After making provision out of revenue for sinking funds for the redemption of annuities and loans on mortgage, amounting in the whole to £1854, there only remains a deficiency of about £2 for the past year. This result, Mr. Diggle remarks, cannot fail to give the greatest possible satisfaction, not only to the Committee, but to all the local authorities within the water-works limits of supply.

Tipton Gas Supply.—In the "Journal" for the 1st inst., we gave the results of the working of the gas undertaking of the Tipton District Council for the past financial year, which showed a net profit of £1211. In presenting the report of the Gas Committee at the last meeting of the Council, the Chairman (Mr. D. Hipkins) stated that during the year they had carbonized 7944 tons of coal—an increase of 306 tons—and had produced 87,110,000 cubic feet of gas, or 5,321,000 cubic feet more than in the year 1895-6. This was due to an improved make per ton of coal; the average of which for the year was 10,965 cubic feet. This was an unusually satisfactory make. The consumption of gas had been 80,801,400 cubic feet, or an increase of 5,723,603 cubic feet; showing a saving in leakage of 402,603 feet. The leakage now only amounted to 7·18 per cent.; being a reduction of 1¼ per cent. on the previous year. The production of residuals had also been very satisfactory, and a favourable revenue had been obtained from coke and ammoniacal liquor. Altogether, their prospects were improving. He did not mean so much in their annual balance-sheets or the probability of a largely increased consumption of gas, but in the fact that within twelve years from then they would have paid off half of their loans, and would be in a position to re-borrow the money. The amount contributed by the gas-works (which are under the management of Mr. Vincent Hughes) to the poor-rate represented between 2d. and 3d. in the pound. Mr. Barrows asked if the Committee, in view of the good balance-sheet presented, contemplated reducing the price of gas. The Chairman replied that the profits pointed to an early decrease in the price; and it would be realized as soon as possible. The report was adopted.

PARLIAMENTARY INTELLIGENCE.

HOUSE OF LORDS COMMITTEE.

Thursday, May 6.

(*Before Lord* FERMANAGH, *Chairman, the Duke of* NEWCASTLE, *Lord* HOPETOUN, *Lord* LAWRENCE, *and Lord* LOCH.)

EASTBOURNE CORPORATION BILL.

This Bill, which was to authorize the Corporation of Eastbourne to purchase the undertaking of the Eastbourne Water Company, and to empower them to construct additional works and supply water within the borough and adjacent places, came before the above-named Committee to-day.

Mr. POPE, Q.C., Mr. WORSLEY TAYLOR, Q.C., and Mr. BOXALL appeared for the promoters. The opponents were represented as follows: The Eastbourne Water Company, by Mr. LITTLER, Q.C., C.B., Mr. BALFOUR BROWNE, Q.C., Mr. FREEMAN, Q.C., and Mr. HONORATIUS LLOYD; the Duke of Devonshire, by Mr. BALFOUR BROWNE, Q.C., and Mr. RICKARDS; owners and lessees of lands, houses, and property in Eastbourne, by Mr. PEMBER, Q.C., and Mr. MARSHALL, Q.C.; and Mr. C. D. Gilbert, by Mr. J. H. GULLY.

Mr. POPE, in opening the case, said the object of the Bill was to enable the Corporation of Eastbourne to purchase the undertaking of the Eastbourne Water Company, and to construct certain works which would be necessary for furnishing an efficient water supply for the town. The substantial question to be decided was whether, under existing circumstances, the supply ought not to be in the hands of the Corporation rather than those of the Company. Both Corporation and Company were agreed that there should be an extension of the works; and the next Bill in the list was one promoted by the Company for this purpose. Eastbourne had expanded into one of the most popular health-resorts on the South coast; and to such a place it was most essential to have a pure and efficient water supply, because if there were any doubt in the minds of the public on this point, it would be destructive to the interests of the town. The opposition to the Bill really centred in the Duke of Devonshire's opinion. He was Chairman of the Water Company, and the greatest landlord in the place; and the opposition, he (Mr. Pope) believed, reflected, in one form or another, his Grace's opinion that the water supply should be retained in the hands of the Company. For the last few years the supply had been intolerable. But the Corporation had no desire to acquire the Company's undertaking at anything below its fair and full commercial value. They were quite prepared to pay whatever an arbitrator, acting without restriction, might award for it; and though the Bill provided for arbitration under the Arbitration Act, inasmuch as it was suggested that this Act did not give as full compensation as the Lands Clauses Act, he was willing to insert the latter Act in the Bill. The rates and charges of the Company were largely in excess of those paid by other boroughs similarly situated in the South of England. Thus, on a £40 house the charge in Brighton was about half, and at Hastings less than half, what it was at Eastbourne. The water had hitherto been drawn chiefly from the well at the Bedford pumping-station; the formation of the country there being chalk. As early as 1892, the water was complained of on account of its excessive hardness; and the Company were asked to take measures to soften it. The supply, however, continued to be unsatisfactory; and on Nov. 19, 1892, the Town Clerk sent a letter to the Company asking if they were willing to sell their undertaking. The reply was in the negative. A Committee of the Town Council was appointed to consider the water question, and they reported that, while the quantity was sufficient, the quality was very hard—so hard, indeed, that some of the pipes had become completely furred. Further, the Committee considered that the charges were excessive; and on the ground of general public policy, and in connection with the continual opening of the roads, they thought it desirable that the Corporation should have control of the water supply. Except that affairs had become more serious, this was practically the present position of the question. In 1895, further complaints were addressed to the Company; and investigations which were made showed that not only was the water very hard, but that, owing to the proximity of the well to the sea, it was extremely brackish. Ultimately the water became so bad that the inhabitants of the lower districts refused to drink it; preferring water drawn from the River Bourne, which was not fit for human consumption. The result was that typhoid fever made its appearance. In October, 1895, the Corporation gave the Company notice that the supply was not within the provisions of the Public Health Act. The Company then said they would go for a further supply to Holywell. The Corporation thereupon decided to promote a Bill for the transfer of the undertaking to them; and this proposition was submitted to the inhabitants, but was rejected by a small majority. Further correspondence took place; and on Feb. 11, 1896, a letter was addressed by the Corporation to the Company giving some of the requirements which the former considered necessary for the safety of the community—viz., an absolutely new supply, to be brought into operation as quickly as possible; the existing well to be abandoned; the water from the new supply to be softened; the Corporation to have the right to purchase within a limited period; and the annual rack-rent on which the Company based their charges to be altered to rateable value. To this letter the Company replied, making practically only the concession that they would proceed to experiment at Wannock with the view of getting more water, though they were told that they could not procure any there. Eventually the Company obtained their Act, and they went to Wannock for their supply; but they were now admitting, by their present Bill, the soundness of the advice the Corporation gave them, and they had gone to Friston. The supply of water was so bad in 1896 that the Corporation again decided to come to Parliament for authority to take over the Company's works; and opinion in the town had then so changed that there was a majority of 1174 ratepayers in favour of this course. In the Bill, power was asked to abandon a portion of the Company's district, and to go to Friston for water; and the Corporation believed they would be able to give Eastbourne a pure and abundant supply much more cheaply than was done at present. As to the finances, he would point out that if the Committee passed the Company's Bill, they would charge the water undertaking with capital, or with power to raise capital, amounting to £312,000; whereas the Corporation Bill would charge it with only £142,000.

The following evidence was then given:—

Alderman *J. A. Skinner*, Mayor of Eastbourne, said he owned considerable property in the borough, the population of which was 43,000, and the rateable value £269,000. He generally bore out the statements made by the learned Counsel who opened the case. For many years the water supply had been unsatisfactory. In recent years, that drawn from the Bedford well had been very hard, and it contained a quantity of chlorine, which made it very unpleasant to drink, and placed it almost out of the question for bathing purposes. Witness was taken at great length through the correspondence which had passed between the Duke of Devonshire, the Water Company, and the Corporation. The reason the Corporation withdrew their opposition to the Company's Bill last year was to allow the Company to get on with the additional works, as the new supply was urgently needed. In 1895 the water was very bad. At the end of that year, and at the beginning of 1896, it improved; but then it became harder, and contained more chlorine—in fact, it was as bad as in 1895. There was only one supply—viz., from the Bedford well. Many people preferred taking water from the Bourne, which was unfit to drink, and caused typhoid fever; and some obtained water from the Star Brewery, where was a private well yielding water of good quality.

By Mr. RICKARDS: Prior to the action of the late Duke of Devonshire in 1859, there was no water supply in Eastbourne. The great objection to the water was not that it was foul or unwholesome, or polluted with sewage, but that it was excessively hard, and contained a great deal of chlorine. The Company had warning some years ago; and they should have prepared a new supply before it failed so terribly. It might be that experts said the water was organically pure.

By Mr. LLOYD: It was not till the Corporation petition against the Company's Bill had been withdrawn that Mr. Gilbert would allow the Company to go upon his land for more water. He should say the Company had not worked with all possible exertion. He knew they commenced work at Friston within five days of obtaining the Act allowing them to do so. He thought they should work there by steam instead of by hand power. At present the water supply was pretty good; and if it continued as it was now, there would not be much to complain of.

In answer to Mr. MARSHALL, witness said he had had a report from Dr. Frankland, stating that the water was now of a very high degree of organic purity, and of most excellent quality for dietetic purposes. He also thought that, when the proposed works were completed, Eastbourne would possess a water supply not to be surpassed, if equalled, in Great Britain. The water undertaking would cost altogether something like £620,000, to repay which in sixty years would entail the borough finding about £28,000 a year. A rate of 1d. in the pound produced about £1000. The total debt of the borough now was, in round figures, a quarter of a million. The works could, he believed, be carried on more economically under the Corporation than they were at present.

Alderman *H. Strange*, Chairman of the Sanitary Committee of the Corporation, gave evidence generally corroborative of the preceding witness's statements. He said the water was so bad that representations were made to his Committee on the subject by several public bodies—the Schoolmasters' Association, the Eastbourne Medical Society, &c. The Company made a number of promises to improve the water; but they did not carry them out. Private people became so alarmed that they had analyses made; and in one case the water was pronounced to be absolutely injurious to health. On this opinion being conveyed to the Company, they replied that they did not agree with the analyst.

Cross-examined by Mr. LITTLER: In a speech he made at a meeting of the Town Council, he said he thought the purchase of the water-works by the Corporation would be a good speculation for the town.

By Mr. BALFOUR BROWNE: He favoured all water undertakings being in the hands of municipalities. It was not because the Company were in difficulties, and were drawing in the salt water, that he thought it would be a good speculation for the Corporation to buy their works.

Friday, May 7.

On the resumption of the proceedings to-day,

Dr. *W. G. Willoughby*, Medical Officer of Health to the Eastbourne Corporation, said that before the present troubles arose, the water was of great organic purity, though hard. It was a little objectionable for washing purposes, but not for drinking. Complaints first arose in 1895. At the end of that year, the quality improved; but it grew worse again in the early part of 1896—rising to 153 grains of chlorine per gallon in September last. On March 4 this year, there were only 4 grains per gallon. Then, from April 1, it steadily grew worse until (on the 28th) the quantity of chlorine was up to 15¼ grains per gallon. The Holywell water was mixed with the Bedford well water; but judging from the analyses, he should say some localities were supplied with Holywell water only. On Sept. 25, he visited the Bedford well, and found, as he expected, that the heading nearest the sea was salter than those further back. There was salt in every part of the well; and in his opinion it should be entirely abandoned for supplying water to the town. Holywell water was supplied through standpipes during the second week of last August; but at the Old Town, where the standpipes were not at first erected, the people used the Bourne stream water. To this he attributed the 59 cases of typhoid, including two deaths, which occurred. The Corporation asked permission of the Company to deliver the pure water from Holywell to the residents in the Old Town; but although they purchased iron tanks for the purpose, permission was refused. If this had been done, these cases would not have occurred. Witness had no private practice; but he had been told by medical men of the town that they had had cases of diarrhœa and dyspepsia which had been caused by the bad water. Doctors living in other parts of the country had informed him they would not send patients to Eastbourne while the water supply was so bad. The death-rate remained very low; and this he attributed to the fact that invalids and visitors did not come to the town. The Company had had to go outside their limits of deviation at Wannock—their first borings being unsuccessful—to get a supply of water; and they had now got a mixture of chalk and rain water, which in summer would be largely decreased.

By Mr. BALFOUR BROWNE: In times of great rain, the water from the

Bedford well, as analyzed by Dr. Blythe, was not organically pure. The 153 grains of chlorine which the water contained at one time might be represented by 200 grains of salt—two-thirds common salt, and one-third calcium chloride. The average number of cases of typhoid in Eastbourne was 18 a year, most of which were imported. Last year, however, the number was 84. According to Dr. Frankland's report, the water at Wannock was satisfactory and organically pure.

By Mr. MARSHALL: The Bedford well was about half a mile from the sea; and its bottom was a good deal below high-water mark, which was a great disadvantage.

Mr. *John Bray*, auctioneer and estate agent, of Eastbourne and Hastings, and an Alderman of the Hastings Corporation, said the water-rate at Hastings was 8d. in the pound on the rateable value; only the very large establishments being charged anything extra. The rate at Eastbourne was 1s. 5½d. in the pound. The bad supply at Eastbourne had greatly affected the prosperity of the place; houses being thrown up after two or three days by season tenants, owing to the bad water.

Cross-examined by Mr. FREEMAN: Hastings did not give a constant supply, though they were now constructing works to do so. On the 8d. rate, there was a considerable loss to the town.

Dr. *Gabbett*, Secretary of the Eastbourne Medical Society, said the Society passed a resolution that the water supply, on account of its excessive hardness and saltness, was unsuitable for drinking and domestic purposes, and that its use was injurious to health. He detailed the steps the Society had taken to get the water improved, and stated that at one time the Company distinctly refused to supply the pure Holywell water to the town, though they could have done so. His Society were of opinion that the Company should abandon the Bedford well, and that the water undertaking should be under the control of the Sanitary Authority.

Mr. *Lewis*, Solicitor, of Eastbourne, said that in October, 1896, in consequence of the unsatisfactory water supply and of the feeling that the Company had not done all they could to remedy it, a Water Consumers' Association was formed. It now numbered between 200 and 300 members, including some of the principal inhabitants. They approved of the action of the Corporation seeking to acquire the water undertaking. There had been many instances of loss directly consequent on the condition of the water supply—the almost total failure of the 1896 season, losses to tradesmen, lodging-house keepers, and owners whose property had been rendered almost unlettable.

Mr. *James Johnstone*, Water Engineer to the Brighton Corporation, gave evidence regarding the charges for water at Brighton, showing that they were much lower than at Eastbourne, though they returned a considerable profit in relief of the rates; the sum being £7500 both last year and the year before.

Mr. *G. F. Deacon*, Engineer of the Vyrnwy scheme of the Liverpool Corporation, said he had given special attention to the method by which sea water found its way into wells near the sea. He was first called in by the Eastbourne Corporation in 1895; and he made a report to the Corporation on the question of the water supply, in which he stated that he believed the attempt of the Water Company to shut off the salt water at Bedford well, by sinking an open trench to the salt heading and using concrete and brick, must prove abortive. Directly a well not far removed from the sea in any sandstone or chalk formation was pumped down below the level of the sea, the water flowed in from the sea. All fine sandstones were excellent filters. As the sea water flowed in, the sandstone became surcharged; but the water in the well remained pure until all the rock between it and the sea became surcharged with the salt. It was evident that the blocking out of a single spring at the Bedford well would not prevent the ingress of salt water; and if the same rate of pumping as at present went on, the existing state of things would be aggravated. In 1891, when the rainfall was fairly high, the chlorine was 7 parts per 100,000. In 1892, it was 19; and the degree of hardness, 30. In 1893, the chlorine rose to 24 parts per 100,000, which made it palpable that the saltness was due to the sea. The warning should have been taken, certainly in 1892, if not earlier. An independent engineer would have drawn attention to the proportion of chlorine, and said it was probably due to sea water. The year 1894 was wet, and there was no notable feature of the water; but in 1895, the chlorine was 40 parts per 100,000. In October, the proportion was 154; and in November, 160. The proportion of solids rose to 344, which, in his experience, was quite unprecedented. Witness also gave the proportions of chlorine at various other dates, showing that it varied with the rainfall; the maximum figure of 160 per 100,000 being reached in August, 1896. This showed that there was an increase of salt, despite the cutting off of the salt spring and the mixing of Holywell water with the Bedford well water. In the autumn of 1896, the proportion of solids was 449 per 100,000. The Bedford well water could not, in his opinion, be used until time had been given for the flow of fresh water from it to the sea to remove the salt from the intervening sandstone. In November, 1895, the Company got to the greensand with their well; but this was not successful in improving the supply. As to the proposal to sink a well at Wannock, there was no evidence of water being there. The situation of the bore, and the exceedingly small area of greensand situated between two impervious beds of clay, indicated that the supply would be very small, if any. Witness came to the conclusion that the only place, within reasonable distance of Eastbourne, from which an adequate supply could be procured by the Corporation was the chalk locality to the west of the town; and in this Professor Boyd Thomas confirmed him. There, there was an escarpment of chalk standing some 400 feet above the town, the fall from which was uniform towards Cuckmere. The valleys in the chalk and the chalk strata dipped in the same direction. On the Eastbourne side, he was of opinion there was practically no water. The water-bearing portion of the chalk was in the highest part; and to gather this water, he proposed in the Corporation Bill of last year to bore a well at Friston, and to drive a heading thence into the Charleston Valley. The Company's Bill of last year proposed a well in the same valley, but not taking in the Charleston Valley. From Friston and Charleston, he estimated they would get at least 2½—probably 3—million gallons a day, with the wells and pumping-stations now proposed. The Corporation scheme was somewhat different from that of last year, because the Company had already begun a well which the Corporation, if they acquired the Company, would accept. The proposal of the Company to put a pumping-station at Charleston Valley was unduly costly, because it only did what could be done in the Friston Valley with an adit. The idea of taking the pipes to Eastbourne over the high part of the downs, as proposed by the Company, would put an undue tax on the pumping-station, unless all the water was to be used at a high level in Eastbourne. The alternative line of the pipes along the sea shore was perfectly satisfactory. It was easy to construct—resting the whole way in sound rock—and perfectly safe. Being longer, it would cost more than the line over the downs; but the outlay would not be greater if the capitalized cost of the extra pumping at Friston were considered. He saw no need for the proposed works at Wannock. By either the Company's or the Corporation's scheme sufficient water could be obtained exclusively from the chalk. A portion of the supply could be derived from Holywell, which would be very advantageous, owing to its nearness to Eastbourne. He thought the management expenses, and the cost of pumping and maintenance in connection with the Company, were very high in relation to the quantity of water pumped and the number of people supplied.

Cross-examined by Mr. BALFOUR BROWNE: Five grains of chlorine per gallon might have been the normal state at Bedford well; but it was not at other wells. This should have been sufficient warning as to the presence of sea water. He was pressed at length to admit that the laying of conduit-pipes on the sea shore was not a good plan; but witness maintained that it was.

Monday, May 10.

Mr. WORSLEY TAYLOR, for the promoters, announced that his clients had decided not to proceed with the portion of the Bill providing for a low-level aqueduct to be laid along the foreshore round Beachy Head.

The CHAIRMAN: It is the opinion of the Committee that the question resolves itself into whether the Company or the Corporation should have the carrying out of the scheme. It appears to us that the abandonment of the shore-line simplifies the matter; and that the two schemes are now practically the same.

Mr. WORSLEY TAYLOR: That is so.

Mr. *Deacon* was then cross-examined.

Mr. BALFOUR BROWNE: You said on Friday that the working expenses of the water undertaking at Eastbourne were very high?

Witness: Yes.

I have instances I could give where the figures work out higher than they do at Eastbourne. Take the case of Croydon, for instance; there the figure is 50·3 per cent. as compared with 43 per cent. at Eastbourne?—I estimated the figure, on the basis of the Company's own accounts, at 46 per cent.

You estimated that in an abnormal year?—No; I took 1892, 1893, and 1894, which were not abnormal years. I find that the percentage in the case of the Kent Company was 35 per cent.

I find it was 38 per cent.?—Then you have included things which you should not.

Mr. *Easton* was then called by Mr. FOXALL, who said the witness would speak as to the advantage of the Corporation having the water-works in their own hands.

Mr. PEMBER objected.

The CHAIRMAN said the Committee were quite able to judge as to the advisability of this.

Mr. *Allcock*, Borough Accountant of Eastbourne, gave the increase in the rateable value of the town since 1884; declaring that it had risen from £133,293 to £270,548. The charges for street-watering, &c., were 7d. and 9d. per 1000 gallons in Eastbourne; and in connection with these figures he mentioned, for purposes of comparison, several towns where the water undertakings were in the hands of the corporation, and where no charge was made for flushing and street-watering.

In cross-examination by Mr. LITTLER, witness admitted that water could not be got for nothing; and that even in the case of a corporation, as a matter of strict account, street-watering would have to be charged on the capital and considered in connection with the sinking fund. He knew that as much as 1s. per 1000 gallons was paid by some towns for street-watering; and that in some cases corporations who had charge of the water supply made a charge against themselves for such purposes.

Mr. LITTLER: You are paying 7d. and 9d. per 1000 gallons?

Witness: Yes.

And the Company have offered to supply you at 6d. Do you think this exorbitant, in view of the figures you have quoted?—No; I do not.

Re-examined by Mr. BOXALL: Do you know that, of the county boroughs, there are only three in which the corporation have not the water supply in their own hands?

Witness: No; I am not aware of that fact.

Mr. WORSLEY TAYLOR said he desired to call Professor Boyd Dawkins to speak on one specific point.

Professor *Dawkins* said he had had considerable experience of engineering works in connection with geological formations, and had studied the question of the supply of water from the chalk to several towns. He had visited Eastbourne frequently, and had interested himself in the question of the water supply.

Mr. WORSLEY TAYLOR: What do you say of the scheme of the Company for obtaining water from Wallnock and Fulching Glen?

Witness: The spot chosen for obtaining water at this place is low down in the chalk, near the bottom of the bed called the grey chalk. This bed of grey chalk is the very driest I know of; and it contains less available water than any other bed in the whole of the chalk formation. I might say that, by a strange accident, the position of the headings which are shown on the map are exactly in the same position, so far as the racks go, as the position which is taken up by the heading which has been driven at Dover for the Channel Tunnel. It is also at the same horizon in the rocks as the place chosen by the French engineers for their portion of the Tunnel works. From my experience at these places, and from my knowledge generally of the grey chalk, I consider there is very little chance indeed of getting any water from these rocks. The position of the Channel Tunnel was chosen simply because this was the driest spot in the whole of the chalk. It is hopeless to think of obtaining any amount of water sufficient for the supply of a place like Eastbourne from these rocks.

The original intention was to get it from the greensand?—The greensand is hopeless for the supply of water to this district.

Cross-examined by Mr. LITTLER: What is your complaint as to our operations in the past?

Witness: I am not complaining.

But I take it you are appearing here for people who are complaining?—Well, I think it ill-advised to attempt to get an additional supply of water by boring further into the greensand.

You know the Company were advised by water engineers of great eminence in their profession?—Yes.

Mr. *James Johnston*, Assoc.M.Inst.C.E., Engineer to the Brighton Corporation, gave evidence to the effect that the Brighton water became contaminated with sea water in 1893, purely owing to an accident. There was a change of engineers; and between the period of the old engineer leaving and the new engineer commencing his duties, the pumps were not managed with discretion, and the wells were too much exhausted.

This concluded the case for the promoters.

Mr. LITTLER, for the Water Company, pointed out that in 1896 the Corporation had withdrawn their Bill, and that what was now taking place was in consequence of a mistake. There was, therefore, nothing to answer. If the Committee thought there was, he would call the Duke of Devonshire and other witnesses. There was no evidence that any advantage would accrue to anyone by the passing of the Bill, because the promoters had no idea as to what the pecuniary results were going to be. There was no evidence that the Corporation would do anything that the Company were not prepared to do—for they had abandoned the low-level line of pipes. This was the last filling of the cup, which surely was now brimming over. There was no evidence that the Corporation scheme would be of any good to the public—on the contrary, it was shown that the owners of property would aid the Company, and not the Corporation. He submitted, therefore, that the case failed; and that there was no reason why the Company should go into a long case when they really had nothing to answer.

The room was cleared while the Committee remained in private deliberation. On the re-admission of the public,

The CHAIRMAN said the Committee decided to go on with the case.

Mr. BALFOUR BROWNE, on behalf of the Duke of Devonshire, said he had anticipated the reply the Committee would give to the appeal of his learned friend. He had thought that they would refuse to stop the case; but he still hoped that, after he had addressed them, without requiring him to call evidence, they would say that the case should not proceed. They knew the enormous interest the Duke of Devonshire had in Eastbourne. They had heard the large sums he had spent; and that the land on which the town was built belonged principally to him. He had a residence there, and had taken a great part in the development of the town. It was obvious that it had been the desire of the late Duke, as it was of the present Duke, to get a good water supply for Eastbourne, whether a large dividend was made out of it or not. The present Duke desired to offer as strenuous an opposition to the Bill as possible. His (Mr. Balfour Browne's) contention was: First, that the Bill was altogether without precedent; secondly, that it was unfair to the Duke and to the Water Company; and, thirdly, that it was contrary to public policy. On the first point, he dealt with the instances in which Parliament had sanctioned the transfer of water undertakings; showing that they were not on all-fours with the present case. In the present instance there were no circumstances which would justify purchase. According to the evidence of Dr. Willoughby, up to 1895 the Water Company did their duty; but in 1895, there was an accident, and the Company drew in chlorine—as every place near the sea was liable to do. Brighton had done it twice; but, luckily for them, they had two other wells. Eastbourne, however, had arranged that whenever they had chlorine in their water, they should go to Hollywell; and they were intending also to go to Friston and Wannock. If the supply from the latter places was not thought satisfactory, the Corporation should have opposed the Bill of 1896 to the end; but this they had failed to do. Then as to the Bill being unfair. What the Corporation proposed was to pay, not the prospective value of the water undertaking, but its existing dividends, which did not represent all the money that had been expended. The Corporation wanted to buy at a time when the Water Company had had a bad accident, and their property was depreciated. With regard to his third point—viz., that the Bill was contrary to public policy—the ratepayers had not assented to it because they did not know what it was. They had agreed to a Bill for compulsory purchase, believing that they would have the right to negative it later on. He submitted that the passing of the Bill would discourage private enterprize—it would show speculators that their property was not safe, and that directly there was a chance of inducing an arbitrator to attach a depreciated value to a water undertaking, a corporation, though not prepared to take any risks, would be allowed to come in and acquire it. To permit an impression of this kind to get abroad, would be most unfortunate as a matter of public policy. The learned Counsel asked the Committee not to allow the Bill to proceed.

The CHAIRMAN said the Committee would hear the evidence of the opponents to the Bill.

Mr. BALFOUR BROWNE said he would not call witnesses on behalf of the Duke of Devonshire, but would submit some evidence for the Water Company.

Mr. *C. Hawksley*, M.Inst.C.E., who had been called in to advise the Eastbourne Water Company, gave evidence in regard to the accident which had happened to the works that led to the letting in of salt water, and the measures which had been taken to remedy the evil. His evidence as to the formation of the country, and as to the causes of the saltness of the Bedford well water, was largely corroborative of Mr. Deacon's. He was strongly of opinion, however, that the Company had done their utmost to remedy the defects in the supply immediately they were discovered.

In cross-examination, witness said an analysis as to the condition of the water might have existed in 1893; but he was not aware of its nature. The commencement of the difficulty was in 1895.

The *Duke of Devonshire* was called, and examined as to his interest in Eastbourne and the Water Company. The latter, he said, was practically at one time the sole property of the late Duke, his father. Witness had several times, in advance of parliamentary powers being obtained, given the Company facilities in regard to the supply of water; and he had supplied the Company on other occasions with funds needed to execute works that were held to be of urgent importance. He did not think the present a good moment for the Corporation to approach the question of purchase. He saw no reason why the Company should be deprived of their undertaking against their will; and he did not believe the Corporation were more likely to consider the interests and advantage of the public than he and the other shareholders of the Company had been in the past.

Mr. WORSLEY TAYLOR: Have you any complaint to make as to the terms under which it is proposed to acquire this undertaking by open arbitration?

Witness: I have not considered the proposed terms. Our position is that we do not wish to sell the property.

The Committee, at this point, cleared the room; and on the public being re-admitted, they intimated that they did not wish to have any more evidence, but that they would hear Counsel in reply.

Mr. WORSLEY TAYLOR, after consulting with his clients and with Mr. Pope, decided, in view of the Committee's intimation, not to deliver the customary speech.

The CHAIRMAN then announced that the Committee did not find the preamble of the Bill proved.

Tuesday, May 11.

EASTBOURNE WATER BILL.

This morning, the Committee proceeded with the consideration of the above-named Bill.

Mr. LITTLER, Q.C., Mr. BALFOUR BROWNE, Q.C., Mr. FREEMAN, Q.C., and Mr. LLOYD appeared for the promoters. Mr. POPE, Q.C., Mr. WORSLEY TAYLOR, Q.C., and Mr. BOXALL represented the Corporation of Eastbourne, who were petitioners against the Bill; and Mr. STATHAM appeared for Mr. Brown and Mrs. Gorringe, petitioning landowners.

Mr. LITTLER, in opening the case for the promoters, explained that the object of the Bill was to enable the Company to raise £100,000 of new capital, and to borrow £25,000 for the construction of new works; the Company having raised the whole of the share and loan capital authorized by the Acts of 1859, 1875, 1881, and 1889. Having completed the works authorized by the first three Acts named, and some of those in the Act of 1889, the Company had taken land belonging to the Duke of Devonshire at Holywell, and constructed works on it which they wished now to have sanctioned. It was expedient that the Company be authorized to raise further money for the purposes of the present Act, and for the general purposes of their undertaking. The new works contemplated were wells at Filching Glen, with headings, pipes, &c., and a pumping-station at Charleston Bottom. The learned Counsel referred to the fact that the Corporation Bill had been rejected on the previous day. They had taken a night to think over the position, and had decided to go on with their petition; but after what had occurred yesterday, he would ask their Lordships to confine them to their petition.

Mr. WORSLEY TAYLOR: We are not here to say that there should not be a new supply of water, as that would be inconsistent with what we set up in our own Bill. But we say that, as a condition of their securing this fresh supply, we should be assured by a provision in the Bill that the town of Eastbourne has a supply of pure and wholesome water—as our petition sets forth—and that we should have it at the earliest possible moment.

Mr. LITTLER said the Company took the ordinary powers, and proposed to complete the works in the ordinary time. There was nothing in the petition to justify the position taken up by his learned friend—no clause referring to an obligation being put on the Company as to the time in which they should do their work, and the way in which they should carry it out. The learned Counsel then went through the major part of the petition of the Corporation paragraph by paragraph. Paragraphs 6 to 10 were as follows:—

> The borough of Eastbourne is within the Company's water limits of supply; and your petitioners are the Urban District Council for the borough, and it is their duty to see that their borough is properly supplied with pure and wholesome water. Your petitioners allege that they and the inhabitants of their borough will be injuriously affected by the provisions of the Bill; and they strongly object to the same. The Company, in the last session of Parliament, promoted a Bill for the purpose of authorizing additional water-works. These works included a pumping-station and wells at Jevington; and your petitioners warned the Company that such works would not prove satisfactory or effective, and would be very costly. The Bill was, however, passed, and the works authorized. But after making several bore-holes on the site of the proposed Jevington pumping-station, the Company abandoned that work, and have since made a shaft in the adjoining valley; and the Bill, amongst other things, proposes to sanction and authorize the completion of that work. The Company have obtained water from the last-mentioned shaft; but your petitioners are advised that it is only surface water, and cannot be relied upon as a permanent source of supply. Your petitioners are advised that the works proposed to be authorized by the Bill are in many respects most unsatisfactory, and have been badly laid out, and will not prove effective, and will involve an unnecessarily large expenditure of money. Your petitioners also object to the additional share and loan capital proposed to be authorized.

How could the Company carry out the works unless they had the money to do it with? They had obtained authority to spend money last year; and they were asking now for further power, which it was evident they needed. The petition continued—

> If the Bill should pass in its present form, the authorized share and loan capital of the Company will have been doubled in two years. The burden of this additional capital must ultimately fall upon the consumers of water within the borough of Eastbourne and neighbourhood; and they have no confidence that the money will be usefully or economically expended.

These were the only words in the petition on which the petitioners could hang their case.

Mr. WORSLEY TAYLOR said his learned friend surely was not going to argue that the petitioners had not a right to be heard under those words. He must not suppose that they had abandoned paragraph 9—namely: "Your petitioners are advised that the works proposed to be authorized by the Bill are in many respects most unsatisfactory, and have been badly laid out, and will not prove effective, and will involve an unnecessarily large expenditure of money." His argument was that the Company were entitled to have a fresh supply of water; but in this part of the petition they asserted that the works proposed would involve "an unnecessarily large expenditure of money."

Mr. LITTLER was surprised to hear his learned friend say this, after

his statement that all his clients wanted was an assurance that the new supply of water would be given at the earliest possible moment. Was his learned friend going to insist on that?

Mr. WORSLEY TAYLOR: Yes.

Mr. LITTLER replied that he had never heard of a more idle insistance. He would call the Engineer; and it was almost an insult to say that such men were wrong in the estimates they made as to the cost of works. But if the works cost less than the estimate, then the full amount of the money authorized in the Bill would not be raised. The promoters could only raise as much money as was wanted for the works; and when they remembered that the Chairman of the Company was the Duke of Devonshire, the allegation in the petition became almost an insult. He had no doubt that, when the Committee had heard the case, they would say that the opposition had been frivolous and vexatious, and would give the promoters their costs. The learned Counsel then dealt with the petition of the owners of property; pointing out that the Committee would have little difficulty in disposing of it.

Mr. *C. Hawksley*, M.Inst.C.E., Consulting Engineer to the Company, was then examined. He said he had read the statements in the Bill as to capital, and could answer for their accuracy, with the exception of the concluding portion. The Company had issued certain capital since the Bill was deposited—namely, the balance of the shares authorized by the Bill of 1889. The Company had constructed the works granted by the early Acts, and were proceeding with those authorized in 1896. He denied that any injury would be done to property by the proposed works, beyond the taking of a small portion for the purpose of laying pipes. But the Company were willing to take only easements, if desired. Referring to the Corporation petition, it was a fact that it was usual in these cases to provide a sufficient amount of capital to carry the Company over some years; and this was necessarily the case. He had prepared an estimate of the capital which would probably be needed during the next twenty years. Up to 1913, £605,704 would be required. This would cover necessary works, and leave a margin of £11,000—a very narrow margin in a case of this kind.

Cross-examined by Mr. STATHAM, witness said that the powers the Company possessed were not exercised to the full extent; but he could not repudiate the suggestion that, if the pumping works at Filching Glen and Wannock were developed to the top of their capacity, the water in the neighbouring streams and rivulets might be reduced in volume. He did not think, however, that the land would be injured thereby. The petitioners (Mr. Brown and Mrs. Gorringe), so far as he knew, were the only landowners who were in a state of alarm as to the probable impounding of the water of the streams and rivulets. He should be ready, on behalf of the Company, to give an undertaking not to do anything beyond running a pipe through the land.

Mr. LITTLER said that the Bill only took power to acquire the underground water. Therefore he would give no undertaking of the kind proposed.

Mr. STATHAM said the petitioners had no ill-will against the Duke of Devonshire or the Water Company. They were neighbouring landowners to his Grace, though in a smaller way; and they wished only to insist on that which was fair. They wanted to prevent their land being deprived of its water—being sucked, as it were.

Witness said that if the petitioners were injured, they would have a remedy under the Lands Clauses Act of 1845 and the Water-Works Clauses Act of 1847.

Cross-examined by Mr. WORSLEY TAYLOR, witness said that, under the Act of 1896, the Company had power to raise £224,000; but they now proposed to omit works to the extent of £100,000. The works at Filching and Friston were proceeding; and when they were completed, the Company would have 2,225,000 gallons of water per day. They wanted from 1,500,000 gallons to 2,000,000 gallons, according to the season of the year. It was in the interest of Eastbourne that a new supply of water should be obtained as soon as possible. He considered that the new supply from Friston would be secured early in the ensuing year—say, in April—and that the new supply from Wannock would be obtained at about the same time.

The CHAIRMAN: Would you not agree to a clause providing that the works should be carried out with all possible dispatch?

Mr. WORSLEY TAYLOR: We would ask that the Company should use their best endeavours to give Eastbourne a temporary supply of wholesome water during the construction of their new works.

Mr. LITTLER: We will do our best in the future, as we have done in the past. We will give the strongest pledge to the Committee to this effect. Even a clause would not require us to do more.

Mr. WORSLEY TAYLOR said he would ask the Committee to require that a temporary supply of water should be brought in from Friston as soon as possible. He had no doubt it could be done before the commencement of the Eastbourne season. He asked witness if it was his contention that there would be a difficulty in obtaining from the makers the pipes which would be necessary to give a speedy supply of water from Friston.

Witness said that was his contention. He had not been to the makers in regard to these pipes; but he had been in communication with them as to other works. The makers just now were full of orders.

Mr. LITTLER said that if possible the work would be done in time for the season. He would undertake that Sir Frederick Bramwell should be made the judge of whether the work could be carried out. Sir Frederick should consult with Mr. Hawksley and Mr. Stillman, the Manager of the Company.

Mr. WORSLEY TAYLOR said he understood that the proposal was that an independent engineer should decide whether the temporary supply of water could be brought in. If he thought it could be, the Company would be willing to do the work.

Mr. LITTLER: Yes; if the Committee think that we should be called upon to spend £7000 in this way.

Mr. WORSLEY TAYLOR asked the Committee to put a clause in the Bill declaring that the Corporation Engineer should have the right to consult with Sir F. Bramwell.

Mr. LITTLER agreed to this.

Mr. WORSLEY TAYLOR said he had another point. There must be something done to soften the water supplied.

Mr. LITTLER: There is nothing in your petition to that effect.

The CHAIRMAN: You are not entitled to go into that matter, as you have not raised it in your petition.

Mr. STATHAM then addressed the Committee for the property-owners. He asked that the Company should be required to skirt the property of the petitioners, and that some provision should be inserted in the Bill putting them on a proper footing as to compensation.

Mr. *Frank Selby*, architect and surveyor, said the proposed works at Wannock would deprive the land of the petitioners of its water.

Mr. STATHAM: I shall be satisfied if the promoters will give an assurance that the pipes will be placed along a reasonable line of road, and that the works will not desiccate the property.

The CHAIRMAN: The Committee do not think that the property will be in any way damaged.

Mr. STATHAM: Not even by desiccation?

The CHAIRMAN: No. With regard to the temporary supply of water, the Committee think it very desirable that an additional supply should be provided before the opening of the Eastbourne season. The Engineers of the Company and the Corporation will see Sir F. Bramwell on the matter; and his decision will be conclusive.

Mr. FREEMAN: We have put the arrangement into writing. It is this: "The Company consent that it should be left to Sir F. Bramwell to confer with the Engineers of the Company and the Corporation, and to decide whether it is practicable to bring in a temporary supply of water from Friston, and deliver the same in Eastbourne, by the 1st of August; and if he so decides, the Company agree to carry out the works." This will be entered on the notes as an offer of mine accepted by the other side.

The preamble of the Bill was then declared proved; and the clauses having been adjusted, the Bill was ordered to be reported to the House.

LEGAL INTELLIGENCE.

SUPREME COURT OF JUDICATURE—COURT OF APPEAL.

Monday, May 31.

(*Before Lords Justices* LINDLEY, LOPES, *and* RIGBY.)

Corporation of Huddersfield v. Ravensthorpe Urban District Council.

This was an appeal by the plaintiffs from an order of Mr. Justice North (see *ante*, p. 601) dismissing an application for an injunction to restrain the defendants from constructing water-works within the plaintiffs' limits of supply. By an Act of 1869, the Corporation of Huddersfield were empowered to construct works and to supply water within a certain district; and by an Act of 1871 their limits were extended so as to include the township of Mirfield, within which Ravensthorpe is situated. In 1867, Ravensthorpe was formed into an urban sanitary district, and had the power to supply water within its own area; so that the plaintiffs had only a concurrent right of supply—in fact, they only laid one pipe and served a few customers. In 1888, the Local Government Act was passed, which gave County Councils the power to rectify boundaries, and take from one district and add to another. Under this Act, an area of about 20 acres was taken out of the township of Mirfield and added to Ravensthorpe; and the Urban District Council were laying mains to supply it with water, which the plaintiffs contended they had no right to do. Ravensthorpe had no water-works proper of its own, but obtained its supply from Dewsbury. The amount of revenue derived by the plaintiffs from the disputed area was at present only about £27 a year; but it was apprehended that building operations would soon be carried out to a considerable extent. In any case, the principle involved was deemed to be of considerable importance. For the respondents, it was urged that the laying of mains was not a construction of water-works within the meaning of the Act; and, further, that the portion of Mirfield in dispute, having been added to the urban sanitary district of Ravensthorpe, became a part of it for all purposes, and consequently the defendants were entitled to supply the inhabitants with water.

Mr. SWINFEN EADY, Q.C., and Mr. A. GLEN appeared for the appellants Mr. VERNON SMITH, Q.C., and Mr. R. C. GLEN for the respondents.

Lord Justice LINDLEY, without calling upon the appellants' Counsel to reply, delivered judgment. He said their Lordships had had an opportunity of looking into the case since it was opened on the previous Friday; and they were of opinion that Mr. Justice North's view could not be supported. In order to make his own opinion clear, he would shortly state how the point arose. In 1864 there was a parish and township called Mirfield, near Huddersfield—one portion of the parish being called the Ravensthorpe district, and the other portion the Mirfield district. In 1867, the Ravensthorpe Local Authority made their water-works—that is to say, they entered into some arrangement with the people of Dewsbury, who supplied water down to the edge of the district, and then the Ravensthorpe people laid down mains for the purpose of distributing the water. In 1868, the Huddersfield Corporation were constituted; and in 1869, a Water Act was obtained which gave the borough powers of supply within the limits mentioned therein. These did not comprise Mirfield, and, of course, did not include Ravensthorpe. In 1871, the powers of the Corporation were extended to Mirfield, and, as he understood, Ravensthorpe was included. If he followed the Acts correctly, there was a joint power of supplying water to these two authorities within the districts he had mentioned. Then in 1895 the County Council made an order, which was duly confirmed by the Local Government Board, putting a little bit of Mirfield—what had been called the "added area"—into the Ravensthorpe district; and they had now to see what was the effect of this with regard to the supply of water. What was the position of affairs before that order was made? The Ravensthorpe people had no right whatever to supply water to the added land, which was out of their district. The Huddersfield people had a right to supply water to the little bit which was so added. They had next to consider whether the effect of the order of the County Council in 1895 rectifying the boundaries of Mirfield parish—for that was really what it was—and putting the little added bit into Ravensthorpe, had extended the power of the Ravensthorpe district to supply it with water. To a certain extent, it appeared to him that it had, because section 51 of the Public Health Act, 1875, came in. But this was followed by section 52, in the nature of a proviso; and what the Huddersfield people said was that there was nothing in the order of the County Council which had deprived them

of their right to supply this added piece with water, and that though Ravensthorpe had a right to supply it by reason of its addition to their district, that right was controlled by section 52, so that they could not supply it unless the Huddersfield people were unable or unwilling to do so themselves. This depended not only on that section, but also on the terms of the order of the Council, and of the authority under which that order was made. Looking at the order itself, one was struck by the circumstance that there was nothing whatever in it about water. Whether the Council, in making the order, contemplated such a discussion as the present, he did not know; but, as far as words went, there was nothing which led one to suppose that their attention was drawn to it. It therefore appeared to him that the order did not decide the question at all, nor did it help the Court to decide it. All that it did was to transfer the added area from the part of the parish of Mirfield in which it was before, into the Ravensthorpe portion, so that the latter became enlarged. They were then driven back to section 52 of the Act of 1875, which provided that, before commencing to construct water-works within the limits of any company empowered to supply water, a local authority should give written notice to every water company within those limits that they were so desirous; stating the purposes for, and the extent to, which the water was required. If went on to say that it should not be lawful for the authority to construct water-works within such limits so long as any company were able and willing to supply water proper and sufficient for all reasonable purposes. One could see perfectly well what the object of this was. If an established water company were in a district, they were not to be disturbed without having notice. The object of giving them notice was obviously, from the language of the clause which followed, that they might consider whether or not they would exercise their powers, or were able and willing to do so; and, if so, they were to be at liberty to exercise them. Then came the question, which, so far as he was aware, was new: Could it be said here with truth that the Ravensthorpe people were "constructing water-works" within this added area, or were they to be regarded as merely extending the old works which they had constructed and laid down in the old district of Ravensthorpe? Having regard to the interpretation section, it seemed to him to be a very strong thing indeed to say that they were not able to construct water-works—he did not understand that they had actually done it—within the added area. Then it was said that they were only extending their old water-works; and reliance was placed on the decision of Mr. Justice Chitty in the case of *The Cleveland Water Company v. The Redcar Local Board.** This decision appeared to him to be perfectly right; and if it had been the other way, the learned Judge would have attributed to section 52 a meaning which everybody could see was never contemplated by the Legislature. But he had not to deal with what the Court had to consider here—an extension of water-works into a new district. He had before him the question of whether the owners of established water works in a particular district were prohibited from extending the works in that district; and he said they were not. They had the right to do this before the Act was passed; and section 52 was not intended to deprive them of it. He (his Lordship) quite followed that; and considered it was right. Mr. Justice North had, he thought, been a little misled by not observing that Mr. Justice Chitty was dealing with a totally different case from the present. On looking at the language of the Act, he could not say that putting pipes into a district into which the Ravensthorpe people had no right whatever to put them before the order of the Council was made, was not constructing water-works within the meaning of the section. In his opinion, it was; and therefore the appeal must be allowed. Care must, however, be taken in regard to the form of the injunction. It ought to be confined to the added area; and he thought the notice of appeal a little too wide.

Lords Justices Lopes and Rigby delivered judgments to practically the same effect.

Some discussion then took place as to the form of the order.

Mr. Swinfen Eady asked for a mandatory injunction calling upon the respondents to remove the mains already laid down.

Mr. Vernon Smith submitted, on the other hand, that the respondents had a perfect right to use water for their own purposes, if not to supply it to the public; and these mains might be useful for this purpose.

Ultimately the injunction was framed so as to restrain the respondents from constructing water-works or using the mains now laid down for the supply of water, with liberty to apply; the appellants to have the costs of the appeal and in the Court below.

* See "Journal," Vol. LXIV., p. 981.

COUNTY OF LONDON ASSESSMENT SESSIONS.

Sessions House, Clerkenwell, E.C.—Friday, June 11.

(*Before* Mr. W. R. M'Connell, *Chairman, and a Bench of Magistrates.*)

The Assessment of the South Metropolitan Gas-Works.

Sir E. Clarke, on behalf of the appellants, said he was there that morning with reference to the application of the judgment already given in this case to the actual figures (see *ante*, p. 844). The figures were, with one exception, agreed, as the Court would see from the tabulated statement handed in and signed by the various Solicitors. Against the Greenwich figures, was a note that the judgment of the Court, if strictly applied, gave £7710 to this parish; being £71 in excess of the rateable value appealed against. He did not quite appreciate this observation: but it was a small matter, and he would leave it. Appended to the table, was a further statement pointing out that the rateable value for the whole of the parishes, according to the judgment of the Court, would be £60,054; whereas the rateable value of the list appealed against was only £57,790. This, the learned Counsel explained, referred to the fact that in the parishes of St. Mary, Battersea, Clapham, and Streatham there was an increase in the figure as arrived at on the basis of the judgment, as against that appealed against. The figure appealed against stood, of course; but the Solicitors wished to make it clear that a higher amount would have been arrived at had the Assessment Committee applied the rule which had now been laid down by the Court. With regard to these three parishes, there was no doubt the judgment sustained the figures of the Assessment Committees. In the parish of St. Paul, Deptford, the figure appealed against was £10,856; and the figure established by the Court, £10,666, or a reduction of £190. In St. Nicholas, Deptford, there was a reduction of £24; and in the parish of Greenwich, the assessment was sustained. In the parish of Woolwich, the apportionment on the basis of the judgment reduced the assessment of £4053 to £3927—a difference of £123; but a question was raised in regard to this figure as to whether £160 in respect of dead mains should not be added, making the rateable value stand at £4087. A letter was written in which, as he understood, Mr. Dinwiddy agreed to the £160 being deducted, but coupled with it a stipulation that it should be without prejudice as to the question of costs. He (learned Counsel) did not see how the point as to costs arose, because Mr. Dinwiddy could hardly mean that there was to be a reduction in the assessment in this parish, and at the same time claim costs as if the assessment had been sustained. In the remaining parishes, the effect of the decision of the Court was to reduce the assessments appealed against as follows: Plumstead, £41, from £3403 to £3362; Charlton, £50, from £1700 to £1650; Kidbrooke, £16, from £502 to £486; Lewisham, £71, from £5386 to £5315; Lee, £64, from £3168 to £3104; and Eltham, £20, from £911 to £891. The result was that in nine parishes there were reductions—small ones, he admitted—which in the aggregate came to about £600. He did not know how the Court proposed to deal with the matter of costs. If it were proposed to give costs to those who had won, then the Court would award them to the three parishes of St. Mary, Battersea, Clapham, and Streatham; and he should in that case certainly apply for costs in respect of the other nine parishes. Of course, the Court might take the other view—that having regard to the results, no costs should be given on either side.

Mr. Marshall said, with regard to St. Mary, Battersea, it was clear that having succeeded there, with a handsome margin, the respondents were entitled to their costs. He also appeared for the Greenwich and Woolwich Unions. Taking Greenwich parish, as distinguished from Greenwich Union, there also there had been a success on the part of the respondents, because the judgment, properly applied, gave the figure in respect of this parish as £7710, in place of the £7639 appealed against. Therefore the parish in this case would be clearly entitled to their costs. As to the general question, he said the result of the appeal substantially had been that all the parishes had succeeded; the difference between the figures appealed against and those found by the Court in seven or eight of the parishes being microscopical—1 or 1½ per cent. at the most. The question for the Court to consider, therefore, was whether the respondents were not entitled to costs all round. Some very important considerations arose in connection with this matter. First, there was the extreme difficulty in fixing the figure for the purpose of the valuation list, which figure had afterwards to stand the test of an appeal. The figure had to be fixed to do justice between the ratepayers on the one hand and the Company on the other. If, as in the case of the Wandsworth Union, the amount was fixed too low, an injustice was done to the ratepayers, because the Court had no power to increase the assessment. This became very conspicuous in the present case in the instances of the rather numerous parishes who settled, without an appeal, upon a figure very much lower than that which the Court now held to be right. It was the duty of the Assessment Committees to fix the figure as high as possible, without doing injustice to the Company. That they had done this with remarkable skill, was shown by the fact that the difference between the assessment and the figure of the Court amounted in many instances to only £20 or £30. Sir E. Clarke, at an early stage in the proceedings, said he was willing to repeat the offer to settle which the Company had made, and which he (Sir Edward) understood was at about 11 per cent., Mr. Livesey afterwards putting the figure at about 12 per cent. Now the Court had held that, in round figures, the proper amount of rateable value was 15¾ per cent.—a very large addition to what the Company offered. It was evident, therefore, that the Company were never willing to pay anything like the sum which the Court had held they ought to pay. The general result of the appeal was that the Court held that the rateable value of the Company's property in the parishes which had been litigated was £60,054; whereas the amount appealed against was £57,790. Therefore, taking it all round, it was clear that the parishes had distinctly won, and by a large amount; the difference being £2264, the rates upon which, 6s. 5d. in the pound, came to about £750 a year. This would be lost to the parishes, chiefly in the Wandsworth Union, and also to a small extent in Greenwich and Woolwich Unions, because the Court could not raise, though they could reduce, rateable value. Then in the other parishes as to which no appeals had been prosecuted, the loss would be enormous—exceeding £7000, the rates on which the Company would put in their pockets. In regard to the Woolwich figures, there was a difference as to dead mains. The parish contended that there was a dead main running through it which ought to be assessed at £160 annual value; while the Company held that the main was tapped in various places, and that therefore the £160 ought to be left out. It seemed that, from the new works at Greenwich, the main—a 30-inch one—ran through Charlton to Woolwich, where for 993 yards it remained a 30-inch main, and then for the remainder of the distance became a 24-inch one. It was tapped to some extent; but it was far too large for the ordinary purposes of a live main. The parish therefore said they would give credit for the difference. They took the structural value of the main at £5014, and deducted £1814; leaving £3200, 5 per cent. upon which gave the £160. The matter was discussed with the Company in 1888, and settled on this basis. If the £160 were added to the rateable value of the property in Woolwich parish, the respondents would win there also. Counsel at this point handed in a table giving particulars of the apportionment of the rateable values among the various parishes where the assessment had been appealed against; the results being much the same as those in Sir E. Clarke's table. He then directed attention to the case of the London and North-Western Railway Company against the City of London Union. The Court decided there against the appellants on the main question of principle raised by the appeal, but made a small reduction in the assessments appealed against, and ordered the appellants to pay the respondents' costs. This was exactly the position in the present instance. The reduction in the North-Western appeal was 8 per cent.; whereas in the present case it was in no instance more than 2 per cent.

Mr. Graham, for the parishes of Clapham and Streatham, where the assessment had been sustained, asked for costs in both appeals.

Mr. PAYNE, on behalf of the parishes in the Lewisham Union, also applied for costs. Taking the three parishes in the Union, the error of the Assessment Committee amounted to no more than £155, which, he submitted, was an extraordinarily accurate result, having regard to the imperfect information at the command of the Committee. He held that the parishes had, substantially speaking, succeeded on the appeal.

Sir E. CLARKE, in reply, said with regard to the £160 in connection with the Woolwich parish, Mr. Marshall had explained that, although this main was not unproductive so far as it went through the parish of Woolwich, a large portion of it must be regarded as unproductive, because that large portion was not used to supply the district, but to carry gas to another place. He hoped the Court would not encourage this kind of thing, which, as far as his experience went, was entirely new, and would lead to very great difficulties. It might be said of almost all the mains of a gas company that they were to some extent, in a parish, unproductive mains; but it would give rise to interminable discussion as to how much of a particular main was productive, and how much unproductive, if the view suggested by Mr. Marshall were adopted. He hoped the Court would maintain the rule that had always been followed—viz., that where a pipe was tapped for the purpose of supplying consumers, it should be considered as a productive main. He therefore asked the Court to disregard the £160; leaving the figure for Woolwich parish at £3927. Mr. Marshall had referred to the North-Western Railway case, where only a small reduction in the assessment was made, and the appellants were directed to pay the costs. It was, however, to be observed that the Sessions there decided against the appellants on the main question of principle raised; making incidentally a small reduction in the assessment appealed against. This case did not therefore apply; for there was no main question of principle in the present appeal on which he had been defeated. So far from this being the case, there were certainly two questions of principle upon which he had been successful—viz., the period to be taken as the account year, and the allowance to be made on the tenant's capital when the amount had been ascertained.

The CHAIRMAN, after consultation with his colleagues on the Bench, said: Regarding the general costs of these appeals, as to the parishes of St. Mary, Battersea, Clapham, and Streatham, the order of the Court is that the respondents are to have their costs; as to the parish of St. Paul, Deptford, the parties are to pay their own costs; as to the parish of St. Nicholas, Deptford, the respondents are to have their costs; as to the parish of Greenwich, the respondents are to have their costs; as to the parishes of Woolwich, Plumstead, Charlton, and Kidbrooke, the parties are to pay their own costs; and as to the parishes of Lewisham, Lee, and Eltham, the parties are to pay their own costs. As to the sum of £160, which has been alluded to this morning on behalf of Woolwich, that is struck out.

ISLE OF WIGHT COUNTY COURT.—Wednesday, June 2.

(*Before His Honour Judge* GYE *and a Jury.*)

Successful Claim of the Ventnor Gas and Water Company for Damage Caused by a Steam-Roller.

This was an action by the Ventnor Gas and Water Company to recover from the District Council £1 11s. for repairs to a gas-main broken by a steam-roller in November last, and also £15 18s. 7d. for loss of gas.

Mr. W. H. WOOLDRIDGE appeared for the Company; Mr. H. C. DAMANT represented the Council.

Mr. WOOLDRIDGE said, in respect to the claim for the loss of gas, his friend had raised a statutory defence that this was not a matter for the ruling of the Court.

Mr. DAMANT submitted that, under the Gas-Works Clauses Act, 1871, any difference arising in respect to the supply or consumption of gas should be settled by arbitration.

His HONOUR thought the claim did not amount to a "supply" of gas within the meaning of the Act.

Mr. DAMANT said they had to consider what consumption meant. Johnson's Dictionary gave the meaning of "consumption" as "waste, spent, or destroyed."

His HONOUR remarked that he was satisfied supply or consumption did not include any accidental escape of gas.

Mr. DAMANT said he should be very pleased to have the issue tried by his Honour and the Jury; but he felt bound to raise what he regarded as a legal objection to the larger claim.

Evidence was then submitted to the effect that a fracture was found in the Company's main in South Grove Road on Nov. 9, caused, it was alleged, by the steam-roller belonging to the Council having been previously at work in the road, which it was said was in a very bad state of repair, with only 10 inches of material on the top of the gas-main. The fracture was a very bad one, being on the top of a sewer which was broken, and into which the gas escaped in volumes, so much so that, on the Saturday previous to the discovery, the Company had to make efforts to keep up a supply of gas to prevent the town being in darkness. A letter was sent to the Council pointing out that the main had been fractured by the steam-roller; and the Surveyor forwarded an order authorizing the main to be repaired. The account for this work was sent in in the regular course; but the charge for loss of gas was sent separately, and an acknowledgment received from the Council, saying it had been referred to the General Purposes Committee. After this no notice was taken of the account, although the Council were written to for a reply.

Mr. *J. S. Ineson*, the Engineer to the Company, stated that dozens of pipes had been broken by the steam-roller; and the repair had been paid for by the Council. No claim had been made for loss of water or gas; witness subsequently explaining that, where the roads were properly made, the fractures would be small, and the loss of gas or water trifling.

Mr. DAMANT, for the defence, contended that the person really responsible was not before the Court. The fracture arose through a drain connected with the sewer breaking away. But this drain was not vested in the Council; and they were not responsible for its repair. It must be shown that there was negligence on the part of the Council, which he maintained had not been proved. He claimed that they were perfectly justified in using a steam-roller in a reasonable and legitimate way. He, as well as his friend, very much regretted the feeling existing between the Company and the Council, which most likely accounted for certain correspondence not being answered. Doubtless if the claim had been confined to the repair of the main, nothing more would have been heard of it; but at the time the Surveyor gave the order for the work to be done without consulting the Council, nothing was said about a charge being made for loss of gas.

Mr. *E. J. Harvey*, the Surveyor to the Council, gave evidence; and, in cross-examination, he said the broken main referred to connected it with the upper house at South Grove Terrace. No steps had been taken to recover from the owner the expense of repairing the junction with the sewer; but he had agreed to pay.

By his HONOUR: The junction-pipe was really a part of the sewer; but the cavity beneath the gas-main was a foot from the sewer.

The Jury, in answer to questions put to them by his Honour, held: (1) That the steam-roller was not a fit and proper roller to use on a road, having regard to its weight; (2) that the roller would have broken the main whether the cavity was there or not; and (3) that the road was not in a proper state of repair. The Jury returned a verdict for the Company for the full amount claimed; and his Honour, in entering judgment for the amount, allowed costs on the higher scale. Execution was stayed to allow of an appeal.

The Charge of Embezzlement against a Gas Company's Collector.

At the Westminster Police Court last Friday, before Mr. Marsham, the final examination, after many remands, took place of Frederick William Jones, late collector in the Hoxton district of The Gaslight and Coke Company. He was charged with embezzlement, falsification of accounts, and the misappropriation of more than £600, the moneys of the Company's outdoor workmen's provident fund, of which fund he was the paid Secretary. Mr. C. O. Humphreys prosecuted; and Mr. Tonkin appeared for the accused. The prisoner had been upwards of twenty years in the service of the Company; and it was alleged that he absconded in October last. Mr. Tonkin addressed the Court for the accused—contending that the charges had not been substantiated. Mr. Marsham said the case must go to a jury; and he committed the prisoner for trial.

Embezzlement by a Gas Collector at Cleethorpes.

At the Grimsby Police Court last Tuesday, Herbert Pulford, clerk and collector, in the employ of the Cleethorpes Gas Company, was charged on remand with embezzling various sums of money from his employers. Mr. E. J. Brockway, Manager of the Company, stated that prisoner was engaged as clerk and collector at the rate of 35s. per week, with house, gas, and rates free. He had charge of a branch office; and, in addition to his salary, he received a commission of 5 per cent. on all sales of gas-fittings, and 6d. per stove let out on hire. This latter ran up to £12 during the past year. Pulford's duties were to deliver and collect accounts; and until the early part of the present year, the work had been very satisfactorily performed. During the March quarter, he complained to the prisoner of the number of outstanding accounts which he thought ought to be collected. Finding, at the end of May, the accounts were still unpaid, he investigated the matter, with the result that several of the consumers produced prisoner's receipt for the amounts standing against them in the Company's books. The total amount of defalcations was £35. Pulford pleaded guilty; and Superintendent Stennett said he thought prisoner had been mixed up with some members of a club in the district where gambling was indulged in. The Magistrates sentenced him to three months' hard labour.

Sales of Shares.—At Brighton, last Wednesday, three lots of £100 of Brighton Corporation 4 per cent. debenture water stock, redeemable on July 1, 1899, realized £103 per lot; eight lots of £100 original ordinary consolidated stock of the Brighton and Hove Gas Company secured £275 10s. per lot; while five lots of £100 of "A" ordinary consolidated stock of the Company made an average of £202 per lot, and ten £200 lots of "B" 6 per cent. preference stock were sold at the rate of £150 per £100. Seven lots of "D" stock of the Tunbridge Wells Gas Company were disposed of at £160 per £100; and a few £10 shares in the Sheppey Gas Company, yielding a dividend of 10 per cent., changed hands at an average of £23 5s. per share. At a recent sale by auction at Stalybridge, 76 original shares of £10 each in the Glossop Gas Company were bought for £1795.

Gas v. Electricity for Street Lighting.—The question of the comparative merits of gas and electricity for street lighting is exciting some interest at Exeter. Since the publication of the letter from Mr. W. A. Padfield, Secretary of the Gas Company, to which reference was made in the "JOURNAL" for the 1st inst. (p. 1256), the local papers have discovered that "gas is not, and does not appear likely to be, played out just yet." The public are advised to "look at the brilliant new light" at the High Street end of Bedford Circus, Exeter, where the Gas Company have placed a Denayrouze cluster burner of high illuminating power. The advocates of the electric light are assured that they "are not to have it all their own way." Indeed, this was made clear by what passed at the last meeting of the City Council. It was then suggested that, after their conference with the Company respecting the terms of the new contract for street lighting, and the proposed arrangements for lighting part of the city with electricity, the Town Clerk and the City Surveyor should report to the Electric Light Committee. The Town Clerk, however, successfully opposed this proposition. He reminded the Council that there was the general lighting of the city to provide for; and the Electric Lighting Committee were concerned with only a very small part of it. It was not wise, he said, to report to a Committee who had nothing to do with the question as a whole. It was decided that the report should be made to the Council; one of the members remarking that they were in the region of experiment, and it might be found wise to let the gas-lamps remain, even in the area which the Electric Lighting Committee wish to take over.

MISCELLANEOUS NEWS.

THE INSPECTION OF GAS LIQUOR AND OTHER WORKS UNDER THE ALKALI ACTS.

The Sub-Inspectors' Reports.

In previous issues of the "JOURNAL," we have noticed the report of the Chief Inspector under the Alkali, &c., Works Regulation Acts (Mr. R. Forbes Carpenter) for the past year. We now give some extracts from the reports of the Sub-Inspectors.

Reporting upon Ireland, Mr. E. G. Ballard states that 25 sulphate of ammonia and 6 tar works were registered in his district last year. The sulphate works continue to be carefully conducted; and it is in only a few of the smaller works that the method of burning the noxious gases evolved in the process of manufacture is still adopted. It is hoped that even some of these may eventually be induced to absorb the sulphuretted hydrogen in oxide of iron, as is done in all the larger works. Taking all the places where sulphate is manufactured in Ireland, the number working on the continuous and intermittent systems of distillation is equal. There were 2594 tons of sulphate of ammonia made in this district during last year. At the works where tar is distilled, every precaution was taken, except in one case, to meet the requirements of the Act.

In the North of England district, which is under the supervision of Mr. B. E. Smith, the number of works registered last year was 125: but the number of separate processes under inspection was 167—45 being connected with the manufacture of sulphate of ammonia, 8 with the distillation of tar, and 2 with that of gas liquor. In sulphate of ammonia works, two additional coke plants were erected during last year in order to recover residuals; making five in all the district. Mr. Smith says the prejudice against coke obtained in these plants seems to be gradually giving way. The output of sulphate amounted to 7223 tons, of which 1029 tons was obtained from coke (residuals) manufacture. In the case of two large sulphate works, the practice of burning the foul gases has been discontinued. In one case, oxide purifiers have been erected, and in the other, the foul gases are burnt over the pyrites burners. He has received the promise that in the remaining four large works, where burning in the retort flues is the treatment employed to deal with the foul gases, oxide plant will be erected during the present year. In all the works for the distillation of tar, efficient means are employed to deal with the gases discharged from the still worms and the pitch coolers.

In the district embracing Cheshire, North Wales, and part of Lancashire, which is under the supervision of Mr. E. G. Ballard, there are 21 sulphate, 5 tar, and 5 gas liquor works; the visits paid to which last year were respectively 100, 29, and 13. Some of the sulphate works are covered by certificates for other branches of manufacture. Continued pressure has been brought to bear upon manufacturers to abandon the plan of burning the noxious vapours, in favour of absorbing them in oxide of iron. Taking all the works together, there are 18 working on the continuous and 5 on the intermittent system of distillation; 17 absorb the sulphuretted hydrogen in oxide of iron, 5 burn it either under boiler fires or in the retort flues, and in one it is converted into sulphur in a Claus kiln. The total amount of sulphate manufactured in the district during the year was 3122 tons. Of the sulphate plants in the district recorded in last year's report, seven have been transferred to a new Sub-Inspector, while one has been added from another district; making a total diminution of six. All the gas liquor works were carefully conducted during the past year; while those for the distillation of tar did not give rise to any complaints of nuisance.

Mr. Herbert Porter, F.I.C., the new Sub-Inspector referred to in the preceding paragraph, has been placed in charge of the North and East Lancashire district, in which 206 processes come under inspection—11 being in respect of gas liquor, 38 of sulphate and muriate of ammonia, and 30 of tar. A quantity of gas liquor equal to 15,935 tons of ammonia was distilled; 97·7 per cent. of it being by the continuous process. The sulphuretted hydrogen evolved during the production of 62·1 per cent. of the sulphate of ammonia made in the district is dealt with by absorption in lime or oxide of iron—mostly by the latter. In previous reports mention has been made of the benefit of moisture in the oxide, in prolonging its activity, as well as being necessary for revivification. In a few cases, steam is employed for this purpose. Many managers are in favour of having the purifiers open, with free access to the air and rain. Mr. Porter says the benefit in many cases is doubtful, as the heavy rains flood the purifiers, causing the oxide to shrink from the sides, or to form water-ways down through the material, leaving free passages for the gases to escape. From careful observation, it has been noticed that, in purifiers constructed of iron, the shrinking of the oxide from the side more often occurs than in the case of brick cement-lined purifiers; probably owing to the fact that from the rougher surface in the latter water has a better chance of escaping gradually. In several cases, there was quite an inch of space between the top layer of oxide and the side of the iron purifiers. At one gas-works, the gases were found to be escaping in this way; there having been very heavy rain the night before. The purifier had been freshly packed a week previously, but had only been in use two days. In a case where a roof is provided over the purifier, this trouble is never noticed. The objection, on the score of nuisance, attending uncovered purifiers from this cause is not compensated for by the possible benefit derived from the moisture, and perhaps freer access to the air. As in most purifiers there is a tendency for the gas to find a passage up the sides, these flanges are now made and attached, in order to baffle the gas. At one works the purifiers are built of stone, which is cheap in the neighbourhood; the width of the sides being from 15 to 18 inches thick. The oxide is banked up above the surface of the purifier wall, and covers the wall itself. Any excess of moisture falling on the oxide drains off, instead of being held as in a basin. In another works—a new addition to the register—there is in operation plant for utilizing the ammoniacal liquor, in the form of caustic ammonia, for the purification of the crude illuminating gas. The process is continuous. The gases uncondensed in the condenser connected with the still are conducted to an ordinary saturator for the formation of sulphate of ammonia, if any (generally a very small quantity), and are then led to a coke scrubber; being finally dealt with by the Claus process for the recovery of the sulphur. Sufficient experience has not been had to say what success has been attained; saving in the cost of purification of the gas being the object in view. At one of the works for the distillation of tar, there was an explosion which was fortunately not of a serious nature, bursting the wrought-iron water-seal vessel. The still gases are carried forward through the condenser, and then on to the boiler fire for combustion by means of a steam injector. Owing to the failure of the steam pressure, the sudden cooling of the steam and gases in the pipes and condenser caused the gases to fire back, and thus the explosion occurred. This would not have been of moment had the swan-neck pipe on the water-seal vessel not been so placed that a considerable volume of gas was always in the vessel on the surface of the water—causing the explosion to be of considerable force. This appears to be a matter not sufficiently thought of by tar distillers when placing fresh vessels of this kind; and in two other cases an alteration has had to be made. The tendency at several works is to improve the existing tar plant in different ways. Larger worms and their cooling-tanks are considered to have advantages, even where the previous worms were quite of the average size.

The East Midland district—a sub-district to that which is under Mr. Porter's supervision—is in the hands of Mr. E. Morley Fletcher. Among the processes under inspection, 27 relate to ammonia, 9 to gas liquor, and 16 to tar distillation. The sulphuretted hydrogen evolved at four of the sulphate of ammonia works is used in the manufacture of vitriol; at the remainder, with the exception of one where the gas is burnt in a Claus kiln, it is absorbed in oxide of iron. Attempts are made at two works to partially revivify the oxide *in situ*. At one, connection between the saturator and the oxide purifier is made with Schwab's hydraulic valve. There are two purifiers; and the plan in use is to work them alternately, three hours at a time, so as to avoid caking of the oxide through too much heat being generated. Revivification is carried on in one works by drawing air through the oxide by means of an air-pump. The exhaust air is forced through a small catch purifier to absorb any sulphuretted hydrogen entangled in the foul oxide and drawn back by the pump. Here, too, a change from one purifier to the other is made every three hours. The oxide is caused to last considerably longer by this means before it is necessary to empty the box for revivification outside. If the air be drawn through faster, so as to completely revivify *in situ*, too much heat is developed, and sufficient time cannot be given for prolonging the process. The total quantity of gas liquor treated last year was equal to 12,645 tons of sulphate; the proportion of the latter and of muriate of ammonia made by continuous processes being 91·4 per cent. The methods of dealing with the foul gases evolved is as follows: Conveyed to vitriol chambers, 45·6 per cent.; absorbed in oxide of iron, 43·1 per cent.; treated by the Claus process, 9·8 per cent.; by other methods, 1·5 per cent. The plant in the tar-distilling works underwent little alteration last year.

In the South Midland district, Mr. E. Jackson has the supervision of 7 gas liquor, 24 tar, and 70 sulphate of ammonia works—four additional works having been added last year. In consequence of meeting with a serious accident late in December, Mr. Jackson could not deal so fully as usual with the work done in his district; and even in the preparation of the report he was able to send in, he was assisted by Dr. A. C. Fryer.

The large district embracing the South-West of England and South Wales is under the supervision of the last-named gentleman. By a re-arrangement of districts, a tract of country, containing some works situated in Hampshire, Berkshire, and Oxfordshire, was removed from his supervision, and placed in the South Midland district. He has now, however, 63 sulphate and 3 muriate of ammonia works, as well as 10 tar-works, to inspect. The total quantity of ammoniacal compounds produced during the past year amounted to 7350 tons, calculated as ammonium sulphate. One sulphate plant was rebuilt, the owners of five works put up new saturators, three enlarged their oxide of iron purifiers, and two now absorb the sulphuretted hydrogen in oxide of iron where previously it was burnt under the boiler fire. Three works possess an arrangement whereby the sulphuretted hydrogen could be burnt if anything went wrong with the oxide of iron purifier. Dr. Fryer had no reason to believe that this method of burning the gases was frequently in use. Nevertheless he felt that it placed a temptation in the hands of a workman; and it was thought he might make use of it when the manager of the works was not even aware of its adoption. Consequently, at his request, these bye-passes have been removed. There is great risk in relying on valves of ordinary construction for shutting off access of foul gas to disused oxide of iron purifiers. The melancholy accident at the Tynemouth Gas-Works early last year strongly emphasizes this statement. In Dr. Fryer's district there are 10 sulphate of ammonia plants possessing duplicate purifiers. At two of these works, hydraulic valves have been in use for a long time; while at three of the plants they were inserted during the year. At the remaining five works, the managers have promised to adopt some form of hydraulic valve without delay. In last year's report, the Chief Inspector drew special attention to the nuisance which may arise from the disposal of the so-called "devil water" from the condensers. The sulphuretted hydrogen is easily removed by filtering it through oxide of iron; or it is still better if the plant is so arranged that the water condensed from the vapours leaving the saturator is drawn off at the hottest possible point. Otherwise sulphuretted hydrogen may be carried in solution into the town sewers. At one works, the "devil water" is evaporated in the ashpits; and thus the offensive steam passes up through the fire, and the noxious gases are burnt. The ingenious form of saturator invented by Mr. C. Stafford Ellery, Assoc.M.Inst.C.E., the Engineer of the Bath Gas Company, and described in last year's report, is still giving satisfaction at the works of the Company. Taking all the places where sulphate and muriate of ammonia are manufactured in the district, the number of works which absorb the sulphuretted hydrogen in oxide purifiers is 57; those burning it, 9; those working on the continuous system of distillation, 30; those on the intermittent system, 36. The continuous process of distillation continues to make progress. At the works where the distillation of tar is carried on, the methods in use for dealing with the two sources of nuisance arising from distillation—viz., gases and vapours escaping from the worm-ends of condensers and the cooling of pitch—are pretty

much as described in last year's report. At one works, however, the gases are passed through scrubbers instead of an oxide of iron purifier being used. New oxide of iron purifiers have been erected at two works; and a few other improvements have been introduced, especially in the direction of properly constructed pitch coolers and bays.

An interesting report is made by Mr. F. Napier Sutton on the work in his district, embracing the eastern and south-eastern counties. In consequence of the continued and ever-increasing pressure of work in this and other districts, a re-arrangement of district boundaries was carried out early last year. The western boundary of his district was moved eastward some 18 miles along its entire length; and by this means it was immediately relieved of a considerable area, consisting of portions of the counties of Bedfordshire, Berkshire, Cambridgeshire, Hampshire, Hertfordshire, Surrey, and Sussex, including 17 works which thus became attached to the Midland district. The number of registered works under inspection last year was 190, as against 208 in 1895; the separate manufacturing processes amounting to 258, compared with 274—75 relating to sulphate of ammonia, 3 to gas liquor, and 16 to tar distillation. Of the 75 works above named, 57 belong to gas companies; and they yield 75·54 per cent. of the total ammonia compounds made. The quantity of ammoniacal products manufactured during the past year amounted to 43,193 tons, calculated as sulphate of ammonia. This is the largest amount yet produced in the district. With the exception of a comparatively small quantity made at those works in which bone carbonizing (animal charcoal) is carried on, all the rest was derived directly from coal in gas manufacture. Since the last report was made, 11 sulphate works have been transferred to another district. The works thus removed had a total production of about 1300 tons of sulphate per annum. One new works was placed on the register of a small provincial gas-works carbonizing some 1500 tons of coal per annum. A small continuous still has been erected; and the foul gases are treated by oxide purification. Considerable advance has again been made, both in the treatment of the foul gases and in the improvement of the distillation plant. The pressure recently brought to bear upon the managers of those works at which the foul gases have hitherto been burnt in the retort flues, has resulted in the discontinuance of the combustion method of disposal at five works; while at two others, plant has been erected for the treatment of the gases by approved methods, including oxide purification and sulphur recovery. Indirectly, these alterations have brought about other important changes; for the old intermittent distillation plant in use at four works has at the same time been removed to make way for modern stills dealing with the liquor by continuous distillation. The proportion of liquor worked up on the continuous plan now amounts to 97·6 per cent. on the whole, as compared with 95 per cent. in 1895. With regard to the methods in use for the treatment of the sulphuretted hydrogen evolved in the different works, Mr. Sutton gives the following figures for the total production of sulphate: Conveyed to vitriol chambers, 61·7 per cent.; treated by the Claus process, 12·2 per cent.; treated by oxide purification, 8·4 per cent.; conveyed to the hydraulic main, 0·5 per cent.; disposed of by combustion, 17·2 per cent. The number of works at which the Claus sulphur-recovery process has been in use throughout the year is seven; and as duplicate plant is employed at three of these, ten separate sets of plant have been in operation. Two more sets, however, exist. One of these started at the end of November; and the second will commence work at the beginning of the year. Mr. Sutton says this process is admirably suitable for the treatment of the foul gases when the quantity to be dealt with is beyond the economic capabilities of oxide purification; and this limit he is inclined to put at a make of from 30 cwt. to 2 tons of sulphate per diem. The treatment of the gases by oxide purification *in toto* is adopted at 41 works; and, with two exceptions, it is carried out satisfactorily. At several of the works, revivification *in situ* is practised with considerable advantage; the intermittent plan by downward draught, when the purifiers are out of action, being that chiefly in use. Very few instances of oxide having been fired by this means have occurred; while attempts to revivify by direct air injection into the foul-gas main or purifier have resulted frequently in over-heating and actual firing of the oxide. The results obtained at the Luton Gas-Works by the latter method have been recorded in recent reports; and the careful experiments that have been carried out there during the past three years have been continued. This work, however, has now been removed from Mr. Sutton's district by the alteration of boundary already alluded to. The results of the past year's work have been recorded in the report of the Chief Inspector (see *ante*, p. 1307). These results, Mr. Sutton says, should be carefully studied. He also refers to the new four-way change-valve fitted to the sulphate plant at the Richmond Gas-works, which will be found illustrated in the "JOURNAL" for last week (p. 1296). With this valve, connection between the foul-gas main inlet and the chimney or spare purifier is impossible. The hydraulic main is utilized at three works for the disposal of the foul gases; but this method is about to be adopted at a fourth works, at which the gases have hitherto been passed to the retort flue. The make of sulphate now is fairly large, and the use of the hydraulic main must be somewhat in the nature of an experiment until its effect upon the gas-purification plant has been demonstrated. Burning the foul gases in the flues of the retorts or by special fires has been strongly discouraged of late; and the measures adopted to bring about improvements in this respect have led to the discontinuance of this method at several works. Among other general improvements carried out at sulphate works may be mentioned the erection of increased distillation plant at three works, with considerably increased purifying area in each case; also additional condensing power at two works where hitherto this was somewhat short. Complaint of alleged nuisance arising from the manufacture of sulphate was received in two instances. Careful inquiry was made into the circumstances; but there was no evidence that the sulphate plants were responsible in either case. Mr. Sutton closes this portion of his report by referring to the unsuccessful action brought by a private individual against the Waltham Abbey Gas Company to recover damages for alleged nuisance caused by the escape of sulphuretted hydrogen from their sulphate plant. This action, in which Mr. Sutton gave evidence on behalf of the Company, was heard by Mr. Justice Wright and a special jury on Dec. 2, 1896, and was reported in the next number of the "JOURNAL." With regard to works for the distillation of tar, no change occurred in the treatment of still gases last year; and the majority of the works are fitted with very efficient and satisfactory means for this purpose. There is, however, room for improvement at a few of the smaller works. The continuous distillation of tar by Lennard's patent stills in use at the works of his firm has been carried on with the greatest success. This appliance was specially referred to by the Chief Inspector in his report. Mr. Sutton states that the two stills treat respectively 16,000 and 24,000 gallons of tar per 24 hours with extraordinary economy of fuel and labour, and with an absolute freedom from the objections generally characteristic of tar distillation.

Mr. W. S. Curphey furnishes a large portion of the material for the Chief Inspector's report for Scotland. He states that the number of sulphate of ammonia works upon the register last year was 65—an increase of one as compared with 1895. The production of sulphate shows an increase over the preceding year, due chiefly to the extended application of recovery plant for the extraction of tar and ammonia from blast-furnace gases. This source of ammonia now ranks second in quantity produced. Prior to 1895, the greatest yield of ammonia salts was from the destructive distillation of shale in connection with the paraffin industry; gas liquor ranking second, and iron blast-furnace gases third. Now gas liquor has fallen back to the third place, despite the increased production in the gas-works of the country. The following figures, representing tons of sulphate, show the relative development in the past five years of ammonia recovery in the three manufactures with which it is associated:—

Works.	1892.	1893.	1894.	1895.	1896.
Shale . . .	23,105	28,485*	32,891*	38,335	37,822
Gas liquor . .	11,898	11,692*	11,447*	12,738	13,310
Furnace gases .	10,500	8,333*	9,675*	14,188	16,111

* Strikes in the coal trade caused many blast-furnaces to be stopped for a time, and affected both shale and gas works.

The number of tar-distilling works upon the register last year was 44, as compared with 43 in the previous year; and works were started for the recovery of tar and ammonia from blast-furnace gases. All these works were carried on without any marked change. The Chief Inspector furnished some interesting particulars in regard to the development of shale distillation which followed the introduction of the "Pentland" retort of Messrs. Young and Beilby in 1884.

COVENTRY CORPORATION GAS SUPPLY.

Annual Report—Increasing Consumption of Gas—Reduction in Price.

At the Meeting of the Coventry City Council last Tuesday, the Gas Committee reported upon the working of the year ending March 31. In regard to the financial result, they stated that, after paying interest on mortgage bonds and annuities, and providing the year's payment of £1405 to the sinking fund, there remained a net surplus profit of £6254. During the year, £3446 had been expended in enlarging and renewing mains and services. This had been rendered necessary by the large increase in the consumption of gas; and the whole of the charge had been met out of revenue. The borrowing powers of the department were now exhausted; and in order to strengthen the financial position in view of an approaching application to Parliament for fresh powers, the Committee recommended that the sum of £2255 be paid into the sinking fund, out of the surplus profits of the year; and the balance, amounting to £4000, or rather more than 6d. in the pound on the district rate assessment, be paid to the general district fund. The Committee also proposed that the price of gas to all persons consuming less than 200,000 cubic feet per quarter be reduced from 2s. 5d. to 2s. 4d. per 1000 cubic feet, as from July 1 next; leaving the price to the larger consumers unaffected.

Alderman ANDREWS, in moving the adoption of the report, said the Council were aware there was an increase in the consumption last year of about 24½ per cent. The total revenue of the undertaking amounted to £71,695, as compared with £59,920 in the previous year; being an increase of £11,775. After paying the whole of the charges connected with the manufacture, there remained a gross profit of £16,049, as compared with £13,935 in the previous year—an increase of £2114. The first charge upon the gross profits was interest on annuities and capital, and also the ordinary charge on sinking fund, which amounted to between £1400 and £1500. After paying these charges, there was left a net profit at the disposal of the Council of £6255, as against £4032 last year, an increase of about 50 per cent., or rather more than £2000. The past year had been in many respects a very costly one for the undertaking, especially in regard to the enlargement of mains. No less than £3446 had been expended in this direction, as compared with an expenditure of £300 or £400 in ordinary years. The whole of this had been paid for out of revenue, so it would be seen that, had it not been for these extraordinary charges, owing to the expansion of the city, and the necessity for having larger mains, the surplus profit would have been £9000 instead of £6000. Many of the mains during the past year had been enlarged to four, five, six, or seven times the capacity of those taken up; and the process would have to go on for another year or two. During the year £1400 had been expended on new mains in new streets; and this amount had been charged to capital account in the usual way. It was recommended that the price of gas be reduced to the smaller consumers from 2s. 5d. to 2s. 4d. per 1000 cubic feet. The feeling of the Committee was that they had done their level best in reducing the price to the manufacturers, who obtained gas on terms as low as those in Birmingham and Leicester. The proposed reduction would mean a difference of 2d. instead of 3d. between the larger and smaller consumers. The Committee were of opinion that, with this alteration, the price of gas would remain at the present figures for years to come, or so long as the cost of materials and coal remained substantially as now. As to the disposal of the £6254 surplus, the Committee recommended that £4000 be handed over to the district rate fund, which would be equivalent to rather more than 6d. in the pound on the rates, and that £2254 be paid as an additional instalment into the sinking fund. He might add that 6d. in the pound was above the average which most Corporations who owned gas-works handed over towards the reduction of the rates. In Birmingham the amount provided for the general district rate was rather under 5d. in the pound. While the Committee thought it was not unreasonable to call upon the gas consumers to provide 6d. in the pound for the relief of the rates, they also thought that 6d. in the pound ought to be enough, and that any further surplus

above 6d. should go to the reduction of the capital account. On this point, he might remark that the Council proposed to apply to Parliament for fresh borrowing powers for the Gas Department, as their funds were exhausted. When they did so, there was a strong probability that Parliament would insert a clause in the new Bill limiting the amount that could be screwed out of the gas consumers for the reduction of the rates. There was another reason why it was considered advisable to hand over £2000 to the sinking fund. They might have their Bill thrown out. Then they would be in the position of wanting money to pay parliamentary expenses; and therefore it was considered advisable to put the extra £2000 into the sinking fund, in order that, if necessary, they might use it for paying the parliamentary expenses. A further reason was that in case of any difficulty or hitch in Parliament in obtaining these powers, they might consider it necessary to put down a third instalment of water-gas plant; and they would then have the money to pay for it. The capital expenditure on gas-works at present, including the water-gas section, amounted to £207,371; and the payments to sinking fund were only £25,700, or about one-tenth of the whole amount, notwithstanding that the Corporation had been in possession of the undertaking rather more than thirteen years. In conclusion, he congratulated the Council on the expansion of the city and on the increase in the consumption of gas. The reduction of 1d. in the price to small consumers would make a difference of about £1000 a year to the undertaking; but, on the other hand, it was certain, judging by the experience of the last two months, that there would be a large increase this year in the revenue, owing to a still further rise in consumption. Therefore, they might anticipate that the £1000 would be easily regained. He also testified to the excellent manner in which the works were managed by Mr. Winstanley, especially during the winter, when they had a demand for as much gas as could possibly be supplied.

Mr. Aviss seconded the motion, which, after a short discussion, was adopted.

WIDNES CORPORATION GAS AND WATER SUPPLY.

Profit on Gas—Loss on Water.

At the Monthly Meeting of the Widnes Town Council last Thursday, Alderman Timmis, in moving the adoption of the minutes of the Gas and Water Committee, said the net profits on the gas account for the year ended the 25th of March last amounted to £2578; but adding the sum spent on public lighting, the actual profit for the year was £3983. This was, he believed, the largest profit they had ever made; and this result was partly due to the introduction of the penny-in-the-slot meters, and partly to economies which had been effected in carrying on the works. For the current year, the price of gas had been reduced; and with this profit, he thought that was a reasonable thing to do. He would point out that during the past nine weeks there had been an increase of 26·4 per cent. in the delivery of gas; and the Committee, with this encouragement before them, anticipated that a profit equal to last year's would be shown at the end of the current twelve months. This would justify them in the reduction they had made. With regard to water, he was sorry to state that there was a loss of £428 9s., whereas in the previous year there was a profit of £1008. Deducting from the loss the amount spent on the Fire Brigade—£202—they had the net loss of £226 on the working of the water undertaking. Though there was this loss, they could not but regard the past year as a most satisfactory one in the water industry, for the reason that but for the extraordinarily heavy and unforeseen expenditure incurred through the subsiding of the wells at Stocks Well, the works would have shown a handsome profit. It was a matter for congratulation that the loss was such a small one. At the same time, he had to point out that there was a loss of revenue in the Water Department, as compared with last year, of £2160; and as they only showed a net loss of £226, it was obvious that the difference between these two sums had been met by the efficiency and economy of the work done. Though, unfortunately, they had a loss on the year's working, the water undertaking was really in a healthy condition at the present time. In the gas undertaking, they had an increase of £140 in their interest account, which was due to the fact that they had augmented their loans very considerably in that department. He could safely assure the ratepayers of Widnes that they had a property in their gas and water works (which are under the supervision of Mr. Isaac Carr, Assoc.M.Inst.C.E.), which was not surpassed by any similar undertakings in the country. The minutes were passed.

NEATH CORPORATION GAS ACCOUNTS.

The annual report of the Manager of the Neath Corporation Gas-Works (Mr. R. Alex. Browning) has been presented by the Gas Committee to the Council, by whom it was considered to be a very satisfactory statement. It first announces that the consumption of gas increases every year, and (notwithstanding the repeated reductions in the price) the profit accordingly. Regarding the loan capital, it is mentioned, that out of £60,500 borrowed, £37,547 has been repaid; leaving a balance of £22,953 now due. The capital account shows that £998 has been expended; leaving a credit balance of £116 to be carried to the next account. As to the revenue account, it is stated that the gross profit amounts to £2997; being an increase of £118 upon the previous year. Coal has cost more by £360, owing to an increase in the quantity carbonized; and the total expenditure has increased by about £371. On the other side of the account, the receipts for gas and meter rental exhibits an advance of about £460, although there is a loss of about £50 by the reduction of the price of gas during a portion of the year. The residual products show a saving of about £30, notwithstanding the loss in the price of coke from 10s. 3d. to 9s. per ton, which means about £119. Sulphate of ammonia is still in a bad state; the prices being lower than last year. The profit on fittings (£198) is lower by £20; but after allowing for the loss in the reductions in the price of gas and coke (£169), the total receipts show an increase of £490. The balance of profit and loss has been appropriated as follows: After paying £1068 interest on loans and bank, £200 has been carried to the depreciation account, which now stands at £390. The sum of £1000 has been transferred for the reduction of principal; leaving a balance of £3865 to be carried to the next account. In conclusion, Mr. Browning stated with regard to the capital account that it will be necessary to further borrow a sum for ordinary expenditure. After meeting all demands, and paying a large sum towards repayment of principal, and also adding to the depreciation account, the Committee have, he says, been putting by the last few years about £700 to the credit of the profit and loss account, which now stands at £3865. Having no working capital, this amount materially assists them in reducing the overdraft at the bank, and since the £2000 capital expenses have been paid to the bank, the overdraft to date stands at £368. As it is unnecessary to keep so much in hand, Mr. Browning suggests that next year the balance of the year's profit be applied as the Committee think proper.

EAST DEREHAM GAS UNDERTAKING.

An Investigation into the Working.

The Gas Committee of the East Dereham District Council have been making a general investigation into the working of the undertaking under their charge, and have recently presented a report on the subject to the Council. In the first place, they dealt with the disposal of the gas produced during the financial year 1896-7. It appeared that the gross quantity made was 11,565,000 cubic feet; and of this, they accounted for 9,217,300 cubic feet. They then made "the usual allowance for escape and waste at 10 per cent., 1,200,000 feet;" still leaving unaccounted for 1,147,600 cubic feet. The cost of manufacture was about 2s. 3d. per 1000 cubic feet. The report also stated that previously no record or account had been kept by any person of the meters belonging to the Council, or in whose possession they were. The Manager (Mr. A. Drage) had, therefore, been requested to produce a correct statement as to the location of all the meters and stoves. The next portion of the report gave an approximate statement as to the coke produced and the manner of its disposal. The price of coke sold to the public is now 16s. 8d. per ton; and the Committee recommended a reduction of 8d. per ton, with a special rate for quantities—*i.e.*, over 10 tons and under 20 tons, 15s. 6d.; and over 20 tons, 15s. per ton. It was calculated that the boiler on the works consumed 155 tons of coke per annum; and the Committee, therefore, proposed that engine coal should in future be used for heating the boiler, as it would be cheaper, and there would be more coke for sale. The station meter was said to be defective; and to this might be attributed some of the unaccounted-for gas. The Committee suggested that the meter be tested; and if necessary put into good order. As to the illuminating power of the gas, the Committee had unexpectedly tested it, and found it to be of 16-candle power, which is 1 candle above the requisite value. On the question of the labour employed and the wages paid at the works, the Committee spoke satisfactorily. Concluding the report they stated that the entire cost of the works was £12,300, and was made up as follows: Purchase of old Company's concern and improvements, £6300; erecting new works, £6000. In 1894-5 the amount spent on repairs and renewals was about £500; 1895-6, £700; and in 1896-7, £693. Taking all things into consideration, the Committee said they could not recommend a reduction in the price of gas to consumers for the present year. The recommendations were adopted, with the exception that a reduction of 10d. per ton on coke for single tons was made, 1s. 2d. per ton for 10 tons and over, and 1s. 8d. per ton for quantities above 20 tons.

INCANDESCENT GAS-LIGHT COMPANY, LIMITED.

The Annual General Meeting of this Company was held last Wednesday, at the Offices, Palmer Street, S.W.—Major-General Beresford in the chair.

The Secretary (Mr. L. de Fonblanque) read the notice convening the meeting; and the report and accounts, to which attention was called last week, were presented.

The Chairman, in moving the adoption of the report and accounts and the declaration of a final dividend of 1s. 5d. on each ordinary and £2 14s. on each preference share, congratulated the shareholders on the remarkable increase in the business of the Company during the past year. The number of burners sold, he said, amounted to close on a million—an increase of nearly 400,000 on the previous year, and 700,000 on the twelvemonth ending March, 1895. It was anticipated that, owing to the increasing adoption of the light in quarters where hitherto it was practically unused, this steady rate of progress could be maintained for many years to come. In regard to street lighting, they had gone ahead, to the complete satisfaction, not only of themselves, but of those who had adopted the system. Having referred to the increasing use of the light in railway stations and public municipal institutions, he stated that it had been the policy of the Directors for the last few years to reduce the price of the burners according to the increase in the sale, and the wisdom of this was proved by the results; for not only had the sales increased in a remarkable manner, but the net profits for the year had likewise increased, notwithstanding the reduction in the prices. It was not fair to compare the net profits for the year ending March, 1896, with those of the past year, as the former included two items which could not properly be reckoned as incidental to the ordinary earnings of the business. These were the sale of the Irish license, and the profit accruing from the increased value of shares held by the Company. The two items amounted to £36,000; but as in the year, they wrote £12,000 off the patent account, this extraordinary profit was reduced to £24,000. Deducting this sum from the net profits for 1895-6, there remained about £68,000; whereas this year, after eliminating similar items, there was left a net profit of more than £95,000—an increase of nearly 40 per cent. The net profit for last year was £118,861, to which was added £20,136 brought forward. Deducting £23,578 for commission payable to the Manager and Chemist, and also deducting £5505 written off the fluid and raw material account, and, after reserving £3937 for debenture redemption, there remained £105,976 available for dividend. Out of this, the interim dividend absorbed £25,941; and the final dividend would amount to £28,031—

leaving about £52,003 to be carried forward. Explaining the reason why, having made such large profits, a smaller dividend was recommended, he said, large as the business was, the Directors were fully convinced they had to reckon with a very considerable expansion in the future. They would this year be extending the scope of their operations by the introduction of an incandescent oil-lamp; and this, together with improvements which they were effecting in both the burner and the mantle, would, while largely increasing the sales and profits, necessitate the command of ample working capital. Their Manager (Mr. Julius Moeller) had represented very strongly to the Board the inadvisability of in any way checking the development of the business by lack of capital; and the Directors fully concurred in his views. Besides, the Directors were of opinion that, considering the large earnings, the present reserve was totally inadequate; and the fact that they were carrying forward almost as much as they had paid for the year in dividend should give a value to the shares considerably in excess of what would have been the case had they doubled the dividends instead of having the money in reserve. The Chairman next referred to the litigation in which the Company had been engaged to support their patent rights, the result of which, he said, had placed their patents in a perfectly impregnable position as regarded any *bonâ-fide* attempt at serious competition. During last winter, they had to deal with a very harassing description of guerilla warfare at the hands of a class of infringers whom it was difficult to stop. These people imported mantles from Germany and elsewhere; and the traffic in them was conducted in such a way that it was difficult to ascertain who was selling them, or where. Hundreds of individuals, trading under various designations, would suddenly open a business, disappear in a short time, and reappear under a new name; and it seemed almost hopeless to get any remedy. However, he thought they had now broken the back of this class of business entirely. An action was also brought by the Company against the New Incandescent (Sunlight) Patent Gas-Light Company; and the Sunlight Incandescent Gas-Lamp Company brought one against them. It would, he remarked, be remembered that they were not entirely successful in the action for infringement against the latter Company last year. But they were so far successful that the Sunlight Company were limited to the use of mantles which would not enable them to seriously compete with the Welsbach mantles; and events had justified the Directors' anticipation on that score. The Board had considered it advisable to bring another action against the Company now manufacturing the Sunlight mantles, as these, they claimed, constituted an infringement of another patent. But they could not say definitely when this case would come on for hearing. The action brought by the Sunlight Company against them would be heard very shortly. Its object was to restrain them from using a process for toughening the mantles for transport, and which, it was claimed by their opponents, was an infringement of the Rawson patent held by them. They had used this process for the past ten years; and it was only lately it had occurred to the patentee that they were infringing his patent. The Sunlight Company, who acquired the patent, consequently brought an action against them; but its importance had diminished owing to the fact that the patent in question was allowed to lapse in September last. Consequently, from that date, they were absolutely at liberty to use the process, whatever might be the decision of the Courts as to the question of infringement prior to that date. On this point, the Directors were satisfied the Company would be fully successful; but, in any event, as the patent had lapsed, the matter was not of importance.

Lieut.-Col. W. T. Ellis seconded the motion.

Mr. P. H. Camperdowne asked whether the Directors were proposing to increase the capital. This was the second year in succession that about one-third of the net profits had been carried forward; and this was a heavy drain on the income. He did not wish to suggest it was bad policy; but personally he thought it would have been better to raise further money.

The Chairman stated that it was not proposed to increase the capital at present. The Directors had come to the conclusion it would place the Company in a better financial position, and in a better position in the eyes of investors, by not dividing the profits up to the hilt.

Mr. Moeller explained that the patents on which the Welsbach mantles were made had only about three years to run; and he thought it would be an enormous responsibility for the Directors to raise any money for this short period for developing the business, because practically it ought to be repaid during that time. He did not mean to say the patents could not be supported for a longer period, because they had one taken out in 1892, which had not up to now been in question in a Court of Law. If it should be decided that the patent was a valid one (as they hoped it would be), then the monopoly of the Company would last much longer. The profits made in the last three years had been divided among the shareholders to such an extent that, in the opinion of the Directors, it was now absolutely necessary to put by a reserve, and to keep back part of the earnings, so that the business might be developed out of the Company's own resources. It must be evident to every shareholder that a business that was supported out of its own earnings had a better foundation than one supported by means of loans. The year's trading had been exceedingly good. When they considered the difficulties they had had, and the uncertain position that the Company occupied when entering into the financial year, he thought the shareholders must agree that the Directors had every right to express the highest satisfaction with the results. He considered the Directors had acted in the interests of the shareholders in taking the course they had.

The Chairman said there was one point in Mr. Moeller's remarks which he should like to make clear. The original patent upon which the actions had been fought and gained expired in three years; but they only worked partially on that now. The fluid was made from a patent acquired in 1892; and though this patent had not been upheld by an action-at-law, they believed it was perfectly valid and good. Mr. Moeller was anxious the shareholders should not run any risk; so he put the life of the patent on the first one, whereas the other was just as good. Answering a question, the Chairman added that he believed they had reduced the price of the lights to a point at which they had practically secured the trade, and would, whether they had a patent or not, be able to pay the shareholders a good dividend.

The retiring Directors and Auditors were afterwards re-elected; and a vote of thanks accorded to the Chairman and Directors concluded the proceedings.

GRAND JUNCTION WATER-WORKS COMPANY.

The Half-Yearly General Assembly of this Company was held at the Office, 65, South Molton Street, last Wednesday—Mr. F. Tendron, F.G.S., in the chair.

The Secretary (Mr. J. Goodwin) having read the notice convening the meeting,

The Chairman moved the adoption of the report and accounts, alluded to last week. He had no doubt, he remarked, that, in looking over the accounts, the enormous amount they paid in law charges for assessment appeals must have struck the proprietors; the amount so expended in the past half year having been £2534. The relief they obtained, however, was but small. The assessments were reduced by an amount which would result in a net saving to the Company of about £1200 during the quinquennium. It was, however, worth effecting this economy, especially as they found that the ratings were cumulative. They never went back, but were continually added to; and the Company felt the pressure exceedingly. During the six years from March 31, 1891, to March 31, 1897, the increase in the rates had been no less than £7800. The shareholders would therefore easily see how necessary it was to resist such an undue increase, as they considered it, whenever a fresh assessment was made. This rise of £7800 in the one item of rating in the past six years compared with an increase during the same period of £5700 in all the other charges. In that time they had raised a good deal of capital—£45,000 in debenture stock and £75,000 in "D" shares—bringing them in nearly £194,000. They now had to bear a charge on this account amounting to £6700 a year. During the past year it had been £6100. Altogether, they had had to face additional charges during the last six years amounting to £20,000. But fortunately their district grew; and the rental had gone up in the same period by £22,000. They therefore had more than sufficient to meet the higher charges they had to face during the remainder of the quinquennial period. He thought they were in a better position than they had been for many years; and they and the combined Water Companies might look forward to a little peace—at all events for the next five years, during which they would themselves set their house thoroughly in order. The money they had raised had gone partly in productive work and partly in strengthening their position by duplicating the weaker portions of their works, by extending the area of their filter-beds, and by getting additional pumping power. They had a good deal of this money remaining, all of which, however, they would spend; but they had incurred the interest on the entire amount. The sum of £6700 represented the whole of the interest they were likely to pay for some little time to come. It was equally so with the rates; and as the increase in the other expenditure—£5700—was almost entirely for the maintenance of works and for larger payments to the Thames Conservancy, there again (excepting that they might have a little more outlay on maintenance for engine power and filter-beds) he thought they might consider that the present income faced the increased expenditure. As during the past year they paid the same dividend as they did six years ago—8½ per cent. (and for the past half year they really earned 9 per cent. per annum)—apart from special expenditure, they were now in the excellent position that they could look forward for the next five years, setting aside the natural growth of their district, to earning a surplus over the 7½ per cent. dividend of at least 1 per cent., or £8500, which they could hold for special expenditure and for building up their reserve fund. He hoped that this special expenditure, which would now consist of the work of lowering the mains, would come to an end in twelve or eighteen months, and that for the remainder of the period they would either put the surplus by, or have the pleasure of paying a small additional dividend after the eighteen months had expired. He trusted, however, that they would never pay away the whole of their earnings, and leave themselves without a reserve fund to meet unforeseen contingencies. They knew that at the end of about five years they would have to meet a considerable addition to their expenditure; that the sinking fund alone, calculated on the basis of 7½ per cent. dividend, would mean 1 per cent. on the maximum amount of the stock; that the interest on the money they had been borrowing gradually would mean another 1 per cent.; and that there must be fresh expenditure of various kinds which might mean ¼, ¾, or another 1 per cent. It would be a great point if he put before them and the absent shareholders that, so long as they were satisfied with the moderate dividend they were now receiving, they could look forward with confidence to its maintenance, even if not to the small increase he had foreshadowed, because he looked to the natural increase in their district to provide the money for interest, for the sinking fund, for interest on the debenture stock, and for the share of expenditure they must incur on working the Staines reservoirs. These works were not likely to be finished within five years; and it was only when water was put into them that the sinking fund would begin to tell. But the interest on the debenture stock would commence six months after it was raised. They had not issued any of the stock yet; but the Staines Reservoirs Committee intended to raise £250,000 of debenture stock guaranteed by the three Companies concerned. This would make one of the very best securities for trustees. They would allot the stock in minimum amounts of £100, but transfers would be allowed of any amount, even of pence; and he should be very much surprised if they did not raise this money, with the guarantee of the three Companies, for less than 2½ per cent., if they considered that the rental in the Grand Junction Company's district had advanced in the past six years by nearly £4000 per annum. During the period that would elapse before they placed water in the Staines reservoirs, and had to meet the sinking fund, they might hope for a further advance in their rental of £20,000 per annum, or even more, with very little additional expense for the greater quantity of water they supplied. If they quietly put by this increase as reserve during the five or six years, they would be in a strong position to meet the sinking fund and other charges, because the interest they would have to pay year by year would not nearly consume the normal augmentation of their revenue. He certainly looked on the position of the Company at present as exceedingly good. The frost, the opposition met with from the London County Council, and the extraordinary expenses they had been put to, had charged their revenue account with about £40,000; but they saw daylight now. Within twelve or eighteen months they would come to the end of all the exceptional expenditure which the frost had entailed; and in the present

Parliament they were not likely to be harassed with the enormous cost which they had had to bear in recent years. There were two matters which affected them. One was the Royal Commission; but they believed that those who formed it were men of ability, and men in whom confidence could be placed, both by the Water Companies and the consumers. He thought that, on the statement he had made, it would be an exceedingly good thing for the ratepayers if they could obtain possession of the Company on anything like the average dividend they had been paying, because it seemed that this was a dividend they were going to maintain, and possibly improve if they chose; and it must be remembered that if they were taken over at any time it would not be on the dividend they paid, but on their earning power. If it had been suggested that the Water Companies should be taken over pretty much at their earning power after a limited period, and that the increase of revenue should be divided something like equally between the consumers and the Companies, he should say that in all probability no simpler measure could be introduced that would be alike to the benefit of the shareholders and the consumers. There was a difference in the position of the various Companies. That which might suit a very rich Company like the New River or the Chelsea would not suit the Grand Junction Company. They had worked for a long time to put their undertaking in the most perfect order; and they desired to go on managing the concern for some years to come—at least until the shareholders reaped the fruit of the self-denial they had been willing to practise on the recommendation of the Directors. The other matter before Parliament was a Bill which should give satisfaction to the water consumers by conferring on them a little additional power, and freeing individuals from expense if they thought they had a grievance against the Company supplying them. So far as this Company was concerned, he did not think they need trouble in the least, provided the law was not set in motion by legal gentlemen who filled the office of Vestry Clerks. If it was a real grievance, or even an imaginary grievance, it was likely to be explained and put an end to without litigation so long as the law was not in a form which made it to the interest of the legal gentlemen mentioned to set it in motion at the cost of the ratepayers and of the Water Companies. They all knew that the London County Council Bills had been withdrawn, in consequence of an adverse vote of the House of Commons of 258 to 123.

The Right Hon. Lord KNUTSFORD seconded the motion; and it was carried unanimously.

The dividends recommended were afterwards declared—at the rate of 7½ per cent. per annum on the ordinary share capital and the £25 "C" shares, and at the rate of 7 per cent. on the £50 "D" shares.

Lord Knutsford and the Hon. Sydney Holland were re-elected Directors—the services of the former being warmly recognized by the Chairman; and Sir John Colomb, M.P., was chosen to fill the vacancy on the Board caused by the death of Mr. H. Whiting.

Sir J. COLOMB having returned thanks,

Mr. J. Best was re-appointed one of the Auditors.

The CHAIRMAN afterwards proposed a resolution for paying £500 a year to the representatives of the Board on the Staines Reservoirs Joint Committee; remarking that this was the remuneration which had been voted by the New River and the West Middlesex Companies to their representatives.

Mr. BAKER seconded the motion, which was carried.

A vote of thanks to the Chairman, Directors, and staff brought the meeting to a close.

The Ventnor Town Council and the Gas and Water Company.—In our "Legal Intelligence" to-day will be found the record of the most recent piece of litigation between the Town Council of Ventnor and the Gas and Water Company, in which the latter came off victorious. In connection with a previous action, the Council's bill of costs against the Company, amounting to £185, has been reduced to £64 by the Taxing Master.

The Depression in the Scotch Oil Industry.—The recently issued annual report of Young's Paraffin Light and Mineral Oil Company, embracing the twelve months ending April 30, furnishes evidence of the depression which prevails in the Scotch oil industry. The balance of the profit and loss account carried forward from last year was £20,038. After expending £19,766 for maintenance, repairs, and improvements, the sum added as the profit of the year is £26,103 5s. 5d. From the total of £46,141, there has been deducted for interest on debenture bonds and stock £18,122; leaving an available balance of £28,013. After paying the interest on the debenture bonds and stock, allowing for depreciation, there is left a balance of £5048, which the Directors recommend should be carried forward. They regret their inability to declare a dividend; but during the year there was a fall in the prices of products, chiefly on solid paraffin, candles, and sulphate of ammonia, amounting to £30,036 on the deliveries; and the valuations of stocks on hand and in process have been correspondingly reduced.

Spalding Gas Supply.—A statement of the accounts of the Spalding Gas-Works, covering a period of a year and a half, ending the 31st of March last, has just been prepared by Mr. J. G. Hawkins, the Manager. It affords evidence of the success of the works; the profit for the period coming out at £2478. The total income amounted to £9763, of which £6708 was from gas rental, and £1963 from the sale of residual products. The expenditure side of the account showed £3749 for coals and freight, £961 for wages, £298 for salaries, and £1569 for discounts and allowances. After allowing for general maintenance expenses, &c., the balance is the amount above stated. The purchase and sale of gas-stoves during the period produced £139—evidencing a further development in this direction. The profit and loss account showed that there was a balance from the previous year of £1845; and the profit already mentioned brought the total balance to £4323. Of this sum, £1752 had been expended on new works, &c. (£832 being a final payment in respect of the new gasholder), and £582 was allowed for street lighting; leaving a balance of £1989 to be carried to next year's account. During the period under review, the total quantity of gas manufactured was nearly 52 million cubic feet; and that sold, nearly 47 millions—the loss through leakage, &c., being just under 9½ per cent. The coal carbonized was 4815 tons; the quantity of gas produced being 10,739 cubic feet per ton. The net cost of the gas per 1000 cubic feet is just under 2s. 0¾d.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

Mr. W. Foulis, the Gas Engineer to the Corporation of Glasgow, who has been called in by the Dundee Corporation in connection with proposed extensions to the gas-works, to report (1) whether the existing ground was fully utilized, and whether additional ground was required for accommodation or extension, (2) what accommodation or extension was required, and what area of ground was needed therefor, and (3) whether it was necessary to acquire further ground to the east, and, if so, what quantity, had a meeting with the Dundee Town Council yesterday. Mr. Foulis stated he had that morning inspected the gas-works, and also the ground to the east; and as the result of his observations he would prepare a report, and forward it on an early date. In the meantime, he would be glad to answer any question that might be put to him, and give any information that might be wished. He indicated that he was in favour of the purchase of the ground to the east, because, he presumed, Dundee was not at a standstill, but, as in the past, would be always going on increasing; and he expressed the opinion that the acquisition of the ground would be of great advantage to the community. Subsequently, a series of questions were put to Mr. Foulis. In the first place, he was asked whether, in the event of extensions being necessary, district stations would be an advantage. He answered that in Glasgow, with its large and ever-increasing population, and where there were works already five miles apart, district works were desirable; but they were not desirable in a city of the size of Dundee. The greater the concentration, the less would be the expense of management. However, he thought that the gas-works of the city could with much advantage be reconstructed, so as to save a great deal of the annual expense, and effect a reduction in the price of gas. He would take this matter into consideration in the preparation of his report. He was next asked whether, in the future, gas made from materials other than coal would not supplant or supersede, in whole or in part, coal gas. Mr. Foulis replied in the negative; and he added that coal would always remain the cheapest raw material from which to distil gas. Next Mr. Foulis was asked whether, if ground could be obtained at another portion of the town at a fourth of the price of that proposed to be acquired on the east of the existing works, it would not be advisable to select the former. Mr. Foulis said this was a very difficult question to answer. It might be that ground acquired at another portion of the town would be very dear, though secured at a sum much less than one-fourth of what was to be paid for the ground on the east of the existing works. After further discussion, consideration of the subject was delayed until Mr. Foulis's report is received.

It is a great comfort to perceive that the long lane of adversity which has been traversed by the Dunbar Gas Commissioners, is at last having a turning. The management of Mr. J. Richmond seems to have effected what none of his predecessors were able to attain to. This week it was announced by Bailie Smith, the Convener of the Gas Committee, at a meeting of the Commissioners, that the price of gas was to be reduced from 5s. 10d. to 5s. 5d. per 1000 cubic feet. The Commissioners should be able to do better than this; and probably they will do so in time.

The Dumfries Gas Commissioners last week agreed to the following contracts: 1600 tons of splint coal, at 9s. 6d. per ton; 500 tons of splint, at 9s.; 500 tons of Lanemark cannel, at 14s.; 1000 tons of Hartley and Eddlewood cannel, at 13s. 6d.; 1000 tons of Allanton cannel, at 12s. 6d.; 500 tons of Earnock cannel, at 11s. 6d.; and 325 tons of blue shale oil, at £3 7s. 8d. per ton.

The Corporation of Kilmarnock formally inaugurated a new gasholder at the end of last week. The holder is a two-lift one, each lift being 30 feet in depth and 100 feet in diameter. The capacity is about 470,000 cubic feet. The cost has been £5500. On May 10, ex-Bailie Calderwood, the Convener of the Gas Committee, turned the gas into the holder; and on Friday of last week, Provost Mackay turned the gas from the holder into the town mains. Before performing the duty which fell to him, the Provost remarked that since the Corporation acquired the gas undertaking they had greatly increased and extended the works; and they had been able to wipe off something like £20,000 of the first cost. In other words, the works had cost the Corporation about £44,000; and to-day, notwithstanding the fact that they had been considerably improved and extended, they only stood as a debit to the extent of £21,000. In these progressive days, they would almost imagine that it would be more fitting if, instead of turning on the gas, they were met to inaugurate electric lighting; and he had no doubt that, as a progressive community, they must look forward to such a ceremony within a very few years. He believed, however, that the Town Council would carefully consider the *pros* and *cons*—the advantages and disadvantages of entering upon a scheme of this nature before they took any practical action. When they acquired the present works, the supply of gas amounted to something like 30 million cubic feet per annum; now they were manufacturing about 110 millions.

The annual meeting of the Milngavie Gas Company, which was held on Monday, furnishes reading which is more interesting than is usually the case at such gatherings. It was reported that the gas produced during the year amounted to 10 million cubic feet; and the loss by leakage was 15·5 per cent.—being 2½ per cent. less than last year. The Works Committee reported that £65 would require to be spent on retorts and benches, and that the small holder was nearly done. Steps would at once require to be taken to provide more storage, as the present capacity was only 34,000 cubic feet; while double this quantity was daily made during the winter. Negotiations are going on with the Glasgow Corporation as to taking over the works. The revenue account during the year amounted to £1939; leaving a balance, after paying expenses, of £326. The cash in the bank is £879; and it was agreed to clear off a loan of £400, and pay a dividend of 5 per cent. The capital of the Company is £4500. The price of gas is 4s. 2d. per 1000 cubic feet, as compared with 8s. 4d. in 1873.

The Philosophical Society of Glasgow on Thursday last presented Mr. Andrew Stewart, of Glasgow—who contributed £15,000 for the foundation of the Adam Smith Chair of Political Economy in the Glasgow University—with an illuminated address enclosed in an embossed silver casket, in recognition of his generosity. The ceremony took place in the Council Room of the Society, when a representative

company of Glasgow citizens were present. Mr. Handaside Dick, President of the Economic Science Section, presided; and in addition to Mr. Stewart, Professor Smart, the first occupant of the newly-founded Chair, was present. Mr. Stewart is of the firm of A. & J. Stewart and Clydesdale, Limited, tube manufacturers, of Glasgow and Coatbridge. He is an extraordinary member of the North British Association of Gas Managers, and contributed largely to the Murdoch Memorial Fund of that body.

Notwithstanding the fact that the price of gas in Glasgow was reduced to the extent of 2d. per 1000 cubic feet for the past year, the Treasurer (Mr. Jas. Fleming) reported on the 26th ult., to the Corporation Gas Committee that the rental up till that day, when there were still five days to run to complete the year, amounted practically to an increase of £2300. In other words, the returns stood at £408,986 13s. 3d., whereas at the corresponding date of the preceding year they amounted to £406,686 15s. 5d.; so that the exact increase for this year was just 2s. 2d. short of the £2300 already mentioned. A fortnight previously, the increase amounted to £4164 1s. 10d. The income derived from the sale of residual products amounted, up to the 30th of April (always one month behind), to £107,906, while for the corresponding portion—eleven months—of the financial year 1895-6 the income derived from the same source came to £110,313; so that in this case there was a reduced income amounting to £2407. But in respect of the decreased revenue from the sale of residuals the Glasgow gas authorities have not much to complain of, as the decrease has been general over the whole kingdom. Possibly when the balance is made up, in the next or succeeding month, it may be found that the difference is relatively less than that which has been mentioned.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *June* 12.

Sulphate of Ammonia.—There continues to be a quiet market. In Scotland, there has been some weakness; but at the English ports, prices have remained steady—the closing quotations being £7 7s. 6d. per ton f.o.b. Leith, £7 10s. per ton f.o.b. Hull, and £7 12s. 6d. per ton f.o.b. Liverpool. Export demand has only been moderate; but, English production being small, makers have been able to maintain a firm attitude. Home consumption is about over. The attention of consumers abroad has been mainly directed to the forward position; but their ideas are rather below those of sellers, who require prompt prices for delivery over the next few months, and a premium of 2s. 6d. to 5s. per ton for delivery up to the end of the year.

Nitrate of Soda is weak at 7s. 4½d. per cwt. for ordinary, and 7s. 6d. per cwt. for fine quality on spot. Due cargoes are only worth 7s. 3d. to 7s. 4½d. per cwt., according to size and test. From what has transpired at the annual meetings of the companies, it would seem that the results of 1896 working have not been satisfactory, and that the prospects for 1897 are anything but promising—the combination notwithstanding.

LONDON, *June* 12.

Tar Products.—This market is as lifeless as it well can be. There are practically no buyers for any of the products for forward delivery. Makers are asking a little more for benzols; but they have no stocks, and are indifferent about selling. The slight recession in the value of crystals reflects itself on crude carbolic, which is weaker. Distillers are smarting under high-priced tar, with the present great collapse in values of products, while it is most difficult to forecast the future.

Market quotations are: Tar, 15s. 6d. to 18s. 6d. Pitch, 18s. to 21s. 6d. Benzol, 90's, 1s. 9½d.; 50's, 1s. 11d. Toluol, 2s. Solvent naphtha, 1s. 6d. Crude, 30 per cent., naphtha, 11d. Creosote, 1½d.; liquid, 2⅛d. Heavy oils, 35s. Carbolic acid, 60's, 2s. Pressed naphthalene, 60s. Creosote salts, 25s. Anthracene, "A," 7d.; "B," 5d.

Sulphate of Ammonia shows no change; but a better feeling obtains among both buyers and sellers. Very little business has been done during the week; and prices have ranged between £7 7s. 6d. and £7 10s., less 3½ per cent., according to port of shipment.

COAL TRADE REPORTS.

From Our Own Correspondents.

Lancashire Coal Trade.—With the pits throughout this district closed, in most cases from Tuesday and Wednesday in last week to Tuesday morning in this, there is practically little or nothing to report in the way or actual business. The position, however, continues generally very steady and a noticeable feature is a tendency to harden in the lower qualities of found coal, owing to a considerably increased demand for shipment, which is enabling collieries to realize as good prices upon shipping orders as they have been obtaining on inland sales. It is exceptional where pit prices are now quoted under 6s. to 6s. 6d. per ton, for ordinary qualities of steam and forge coals; while on shipping orders 7s. 9d. per ton represents about the figure for common sorts, and better qualities are readily fetching 8s. 3d. to 8s. 6d., delivered at the ports on the Mersey. This hardening on common coals may possibly have some effect upon gas coals, though, as reported last week, the 1896 prices seem, so far, to be the general basis upon which contracts are being renewed. Contracts for locomotive fuel are, however, still more likely to be affected; and, as intimated recently, many of the colliery owners have been showing a disposition not to enter into contracts with the railway companies, unless they can get some better prices than they had to accept last year. The better qualities of round coal show some tendency to weaken; but there is no quotable giving way in list rates, and collieries that usually contract over twelve months are endeavouring to hold out for some advance upon the low prices of last year. As, however, contracts are not generally settled until July, it remains to be seen whether any better prices can really be obtained. The general pit prices are about 10s. per ton for best Wigan Arley, 8s. to 8s. 6d. for Pemberton four feet and seconds Arley, and 6s. 6d. to 7s. for common house coal. Engine fuel maintained a strong position; and the output in the better qualities is barely sufficient to meet the demand. At the pit mouth, common slack remains about 3s. 3d. to 3s. 6d. per ton; medium sorts, 3s. 9d. to 4s. 3d.; and better qualities, 4s. 6d. to 5s.

Northern Coal Trade.—There has been more activity of late; and in view of the stoppage that the Jubilee will cause, there is a desire to get

GAS AND WATER COMPANIES' STOCK AND SHARE LIST (see ante, p. 1349).

Issue.	Share.	When ex-Dividend.	Dividend or Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p. c.	GAS COMPANIES.			£ s. d.
590,000	10	9 Apl.	10½	Alliance & Dublin 10 p. c.	23—25	..	4 4 0
100,000	10	,,	7½	Do. 7 p. c.	17½—18½	..	4 1 1
300,000	100	2 Jan.	5	Australian (Sydney) 5 % Deb.	108—111	..	4 10 11
200,000	10	27 May	7	Belgrano (B. Ayres), Limited	9½—10	..	7 0 0
100,000	Stck.	30 Dec.	5	Do. 5 p. c. Deb. Stk	104—107	..	4 13 5
200,000	5	27 May	6½	Bombay, Limited	6⅛—7	..	4 5 9
40,000	5	,,	6½	Do. New, £4 paid	5⅞—5⅞	..	4 10 7
380,000	Stck.	26 Feb.	12	Brentford Consolidated	297—303	..	5 19 7
240,000	,,	,,	9	Do. New	223—228	..	3 18 7
50,000	,,	,,	5	Do. 5 p. c. Pref.	145—150	..	3 6 8
159,375	,,	11 June	4	Do. 4 p. c. Deb. Stock.	130—134*	+2	2 19 9
220,000	Stck.	25 Mar.	11½	Brighton & Hove Original	273—278	..	4 2 8
208,820	,,	,,	8½	Do. A Ord. Stk.	197—202	..	4 4 2
933,500	Stck.	26 Feb.	5	Bristol, 5 p.c. max.	130—135	..	3 14 1
420,000	20	26 Mar.	11½	British	56—57	..	3 18 11
50,000	10	26 Feb.	11½	Bromley, Ordinary 10 p. c.	23—25	..	4 12 0
71,000	10	,,	8½	Do. 7 p. c.	18—20	..	4 5 0
500,000	10	28 Apl.	6	Buenos Ayres (New) Limited	10—10¼	+¼	5 14 3
200,000	100	2 Jan.	6	Do. 6 p. c. Deb.	101—103	..	5 16 6
150,000	20	26 Feb.	8½	Cagliari, Limited	30—32	..	5 3 1
100,000	10	11 June	8	Cape Town & District, Ltd	16½—17½*	..	4 11 8
50,000	50	3 May	6	Do. 6 p. c. 1st Mort.	57—59	..	5 1 8
550,000	Stck.	9 Apl.	13½	Commercial Old Stock	342—347	..	3 17 9
165,000	,,	,,	10½	Do. New do.	257—262	..	4 0 1
165,000	,,	11 June	4½	Do. 4½ p. c. Deb. do.	150—155*	+2½	2 18 0
800,000	Stck.	11 June	13	Continental Union, Limited.	250—255*	..	5 1 11
200,000	,,	,,	10	Do. 7 p. c. Pref.	212—217*	..	4 12 2
51,600	Stck.	26 Feb.	14	Croydon Com'cial A 10 p. c.	317—322	..	4 6 11
163,400	,,	,,	11	Do. B 7 p. c.	255—260	..	4 4 7
535,000	Stck.	26 Feb.	5½	Crystal Palace Ord. 5 p. c. Stk	139—142	..	3 13 11
60,000	,,	,,	5	Do. 5 p. c. Pref.	140—143	..	3 9 11
486,090	10	29 Jan.	11	European, Limited	24½—25½	..	4 6 3
354,060	10	,,	11	Do. £7 10s. paid	18—19	+½	4 6 11
5,896,590	Stck.	12 Feb.	12¾	Gaslight & Coke, A, Ordinary	312—317	..	4 0 5
100,000	,,	,,	4	Do. B, 4 p. c. max.	112—117	..	3 8 5
665,000	,,	,,	10	Do. C, D, & E, 10 p. c. Pf.	312—317	..	3 3 1
30,000	,,	,,	5	Do. F, 5 p. c. Prf.	150—155	..	3 4 6
60,000	,,	,,	7½	Do. G, 7½ p. c. do.	220—225	..	3 6 8
1,300,000	,,	,,	7	Do. H, 7 p. c. max.	207—212	..	3 6 0
463,000	,,	,,	10	Do. J, 10 p. c. Prf.	312—317	..	3 3 1
476,000	,,	,,	6	Do. K, 6 p. c. Prf.	182—187	..	3 4 2
1,061,150	,,	11 June	4	Do. 4 p. c. Deb. Stk.	138—141*	..	2 16 9
294,850	,,	,,	4½	Do. 4½ p. c. do.	150—155*	+½	2 18 0
908,000	,,	,,	6	Do. 6 p. c. do.	205—210*	+1	2 17 1
70,000	10	13 May	6	Hongkong & China, Limited	13—14	..	4 5 10
3,800,000	Stck.	13 May	10	Imperial Continental	212—217	..	4 12 2
376,400	100	1 Feb.	4	Do. 4 p. c. Debs. Red.	100—103	..	3 17 8
473,600	Stck.	12 Feb.	3½	Do. 3½ p. c. Deb. Stk ,,	104—107	..	3 5 5
75,000	5	11 Dec.	6	Malta & Mediterranean, Ltd.	5⅜—6½	..	4 16 2
560,000	100	1 Apl.	5	Met. of Melbourne, 5 p. c. Deb.	112—114	..	4 7 8
250,000	100	,,	4½	Do. 4½ p. c. Debs.	107—109	..	4 2 7
541,920	20	11 June	5	Monte Video, Limited	14—15*	..	6 13 4
150,000	5	27 May	8	Oriental, Limited	8⅛—8⅜	..	4 11 5
135,000	5	,,	8	Do. New, £4 10s. paid	7⅛—7⅜	..	4 12 10
15,000	5	,,	8	Do. do. 1879, £1 paid	1⅞—2*	..	4 0 0
60,000	5	26 Mar.	7	Ottoman, Limited	5—5⅛	..	6 7 3
420,000	100	3 May	6	People's Gas) 1st Mtg. Bds.	104—109	..	5 10 1
500,000	100	1 June	6	of Chicago) 2nd Do.	105—110	..	5 9 1
250,000	10	27 May	10	San Paulo, Limited	14—15	..	6 13 4
5,475,000	Stck.	26 Feb.	5½	South Metrop., 4 p.c. Ord.	141—144	..	3 12 11
1,416,667	,,	—	3	Do. 3 p.c. Deb. Stk.	107—110	..	2 14 7
60,000	Stck.	12 Mar.	11½	Tottenham & Edmonton, A	275—285	..	4 0 10
60,000	,,	,,	8½	Do. B	190—200	..	4 5 0
182,380	10	27 May	10	Tuscan, Limited	13½—14½	..	6 18 0
149,900	10	2 Jan.	5	Do. 5 p. c. Debs. Red.	102—105	..	4 15 3
				WATER COMPANIES.			
746,159	Stck.	30 Dec.	10½	Chelsea, Ordinary	330—335	..	3 2 8
150,000	,,	,,	5	Do. 5 p. c. Pref.	175—180	..	2 15 6
160,000	,,	,,	4½	Do. 4½ p. c. Pref. Stk., 1875	158—162	..	2 15 6
175,785	,,	26 Mar.	4½	Do. 4½ p. c. Deb. Stock	160—165	..	2 14 6
1,720,560	Stck.	9 Apl.	7	East London, Ordinary	221—225	..	3 2 9
654,740	,,	30 Dec.	4½	Do. 4½ p. c. Deb. Stk.	164—169	..	2 13 4
399,000	,,	,,	3	Do. 3 p. c. Deb. Stk.	107—109	..	2 15 0
700,000	50	11 June	7½	Grand Junction, 10 p.c. max.	117—122*	..	3 1 6
295,000	Stck.	26 Mar.	4	Do. 4 p. c. Deb. Stk.	148—153	..	2 12 4
708,000	Stck.	12 Feb.	12	Kent	345—350	+3	3 8 7
160,000	,,	,,	7	Do. New, 7 p. c. max.	212—217	..	3 4 6
1,043,800	100	30 Dec.	9¾†	Lambeth, 10 p. c. max.	283—288	..	3 7 8
406,200	100	,,	7½	Do. 7½ p. c. max.	220—225	..	3 6 8
350,000	Stck.	26 Mar.	4	Do. 4 p. c. Deb. Stk.	147—150	..	2 13 4
500,000	100	12 Feb.	13	New River, New Shares.	423—428	..	3 0 8
1,000,000	Stck.	29 Jan.	4	Do. 4 p. c. Deb. Stk.	152—155	..	2 11 7
902,300	Stck.	30 Dec.	6	S'thwk & V'xhall, Ordinary	160—168	+2	3 12 9
126,500	100	,,	6	Do. Do. 7½ p. c. Max.	150—155	..	3 17 5
489,200	Stck.	,,	5	Do. Do. 5 p. c. Pref.	175—180	..	2 15 7
1,019,585	,,	9 Apl.	4	Do. 4 p. c. A Deb. Stk.	145—148	..	2 14 2
1,155,066	Stck.	11 June	13	West Middlesex	310—315*	+2	3 3 6
200,000	,,	,,	4½	Do. 4½ p. c. Deb. Stk.	162—167*	+1½	2 13 11

† Next dividend will be at this rate. *Ex div.

shipments of coal well forward. Thus many of the collieries are very fully employed. In the steam coal trade this is the rule; the Northumbrian pits being at work full time. The price is firm at about 8s. 6d. per ton f.o.b. for best steam coals; second qualities, 8s.; and steam smalls, 3s. 6d. to 3s. 9d. In the Durham coal trade, there is not so general an activity; the demand for gas and household coals being now at its lowest point. Gas coals are rather firmer, though the local consumption is very low. Generally, the quotation is about 6s. 10½d. to 7s. 3d. per ton f.o.b. for occasional cargoes. There is no alteration in gas coke this week, either in price or in position.

Scotch Coal Trade.—Except for splint, the demand for all classes of coal continues good. The outlet is improving, both at home and abroad. Even in the demand for domestic consumption, there has not been the falling off which is usually experienced in summer; but this is to be accounted for by the coldness of the weather. Steam and ell are in good request, particularly the latter, for export purposes, which is an indication of the gradual return of foreign contracts. Main is unchanged. The prices quoted are: Main, 6s. 3d. to 6s. 6d. per ton f.o.b. Glasgow; ell, 7s. to 7s. 6d.; and splint, 6s. 6d. to 6s. 9d. The shipments for the week amounted to 147,334 tons—a decrease on the preceding week of 24,060 tons, but an increase over the corresponding week of last year of 5012 tons. For the year to date, the total shipments have been 3,114,107 tons—an increase when compared with the corresponding period of last year of 127,623 tons.

Kirkby Lonsdale Gas-Works.—The shareholders of the Kirkby Lonsdale Gas Company have authorized the Directors to enter into negotiations for the sale of their works to the District Council on the basis of arbitration.

New Joint-Stock Companies.—The following joint-stock companies have lately been registered: Birmingham Oxygen Company, Limited, with a capital of £5000, in £1 shares (1000 deferred), to acquire the undertaking of the Birmingham Oxygen Company, Limited, to enter into a certain agreement, and to manufacture, compress, and sell oxygen, hydrogen, nitrogen, carbonic acid, &c. J. W. Cook, Limited, with a capital of £210,000, in £5 shares (21,000 preference), to acquire certain businesses, and to construct and maintain gas, water, and electric light works. The Inclined Retort Construction Company, Limited, with a capital of £20,000, in £1 shares, to carry on the business of inclined retort constructors, founders, smelters, iron and steel converters, engineers, merchants, factors, tool makers, boiler makers, &c. Safety Incandescent Lamp Syndicate, Limited, with a capital of £10,000 in £1 shares, to manufacture, sell, import, export, and deal in lamps, burners, gas mantles, glasses, shades, &c., for lighting purposes. H. Simon, Limited, with a capital of £100,000, in £10 shares, to carry on the business of milling engineers, &c., in Manchester and Australia. The Liver Acetylene Gas Company, Limited, with a capital of £1000, in £10 shares, to carry on in Liverpool and elsewhere the business of manufacturers of, and dealers in, acetylene and other illuminants, machinists, mechanical engineers, and merchants.

Bury Corporation Gas Supply.—At the last monthly meeting of the Bury Town Council, the annual report of the Gas Manager (Mr. W. H. S. Gendall) for the past financial year, was submitted and approved. It showed that there had again been an increased consumption of gas by 10,526,880 cubic feet, or 3·6 per cent. Notwithstanding this, however, the profit was only £213, as compared with £1969 in the year 1895-6. The reasons given for this are, first, that the residual market has been very unsettled, with prices lower than they have been for some years; and, secondly, the reduction in the price of gas to 2s. 3d. per 1000 cubic feet, less 1d. for prompt payment, in the old borough, and 3s. per 1000 cubic feet, less 1d., in the added areas. The total quantity of gas made was 323,459,000 cubic feet.

The Drawback on Coke at Ipswich.—At a meeting of the Ipswich Dock Commissioners last Friday, the Committee of Management recommended that the Commission should discontinue the drawback on coke manufactured in the town as from the 10th of September next; this being the date on which the existing scale of drawbacks will expire. The Chairman (Mr. T. Calver Mason) said the Gas Company had entered into certain contracts on the strength of the drawback, and this was why the Commission were recommended not to determine it until the date named. Mr. Cattermole expressed surprise at the recommendation, for clearly, on the advice of Counsel, the drawback was, he said, illegal, and those who supported the recommendation would be incurring a liability which they might have to pay. He was as anxious as anyone to be fair to the Company; and therefore, instead of going back several years, and seeking to recover what had been allowed to them for coke, he was willing to grant everything up to the date of Counsel's opinion. He moved that the recommendation be expunged. Mr. Alderton seconded the motion; but on the matter being put to the vote, the recommendation was adopted by 16 votes to 6.

The Assessment of the Torquay Gas-Works.—The Directors of the Torquay Gas Company have had an unusual, and certainly a pleasant, experience in connection with the assessment of their undertaking. Two years ago, the Overseers intimated that they intended to obtain a re-valuation of the mains in the borough of Torquay. The previous valuation had been made in 1880. The Directors replied that a decrease rather than an increase should be made in the assessment, and advised the Overseers not to move in the matter. However, the latter raised the valuation from £3000 gross and £2400 rateable value to £3500 gross and £2800 rateable. Against this the Company appealed to the Assessment Committee of the Newton Abbot Union. The evidence of experts was obtained both on behalf of the Company and of the Committee, with the result that the Committee last month reduced the rateable value to £1920. This concession did not satisfy the Company, who, as the question had been opened, pressed for a reduction to the amount at which the mains were valued by their witnesses. The Committee have now compromised the matter by further reducing the rateable value to £1750. Instead of increasing the rateable value of the mains, the Overseers have thus contributed to a reduction of £650, which, as a local paper sadly remarks, involves a loss to the borough finances of nearly £200 a year.

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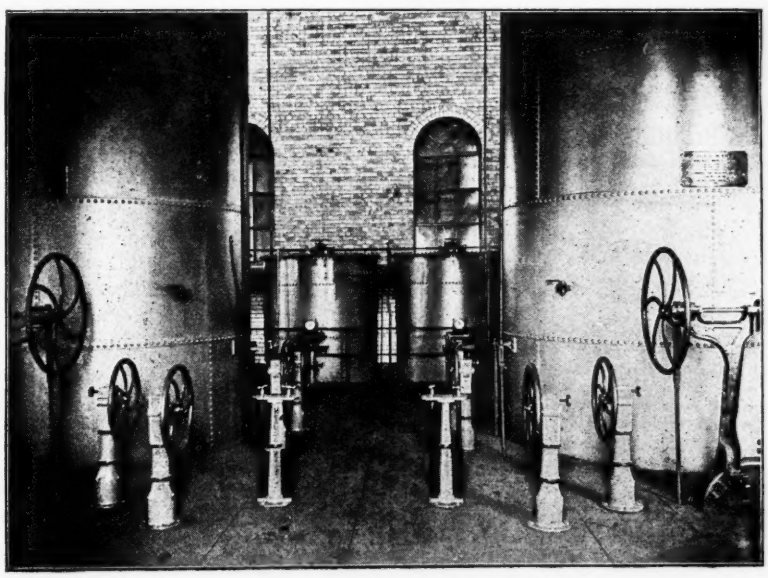

RESULTS PROVE EFFICIENCY.

Working Floor of Generator House. One Quarter Section of Birmingham Plant, Windsor Street Station.

New Water-Works at Bath.—A new reservoir at Monkswood in connection with the Bath Corporation Water-Works was formally brought into service last Tuesday by the Mayor (Mr. G. Woodiwiss). Altogether the work, land, &c., has cost about £36,000. The reservoir is 9 acres in extent; and at only one end has it been necessary to raise an artificial embankment—the other sides being formed by the natural contour of the ground. The reservoir has a capacity for 51 million gallons.

Wokingham Corporation Gas Affairs.—According to the annual report of the Gas Committee of the Wokingham Corporation, there is a deficiency of storage accommodation at the works; and it is proposed to apply to the Local Government Board for power to borrow £1000 to enable the Committee to have a new holder completed before the winter of 1898. During the past year, a substantial increase in the receipts was gained, chiefly from the sale of nearly 700,000 cubic feet in excess of the previous year.

Precautions against Fire at the Jubilee Celebrations.—In addition to the provision which the New River Company have made, as recorded in the "JOURNAL" last week, for the supply of free drinking water in the portions of their district traversed by the procession on the 22nd inst., the Company have taken the necessary steps to meet any emergency which may arise requiring the prompt supply of water. At certain points, of which the public authorities concerned have had notice, men and all the needful appliances will be kept in reserve throughout the day, ready to act as circumstances may require.

Charges for Motive Power at West Bromwich.—A special meeting of the West Bromwich Corporation Gas Committee was held last Friday, for the purpose of considering reports with reference to the use of gas for motive power, with the view to a revision of existing rates. It appeared that there were 45 gas-engines in the borough on March 31 last. The total nominal horse power of the engines was 250; and the aggregate estimated consumption of gas was 9,481,900 cubic feet per annum. A scale of charges was submitted for consideration, ranging from 1s. 6d. per 1000 feet to consumers of a million cubic feet and upwards per quarter down to 2s. 3d. to consumers of less than 100,000 cubic feet per quarter.

The Torrington Corporation and the Water-Works.—The negotiations for the transfer of the Torrington Water-Works to the Corporation have now been completed. The question has been under consideration for some time. Complaints have been made of the inadequacy of the supply, and, the Water Company being unable or unwilling to provide more, it was suggested that the Corporation should take over the works and the responsibility for the supply of the town. A sum of £6080 was agreed upon; but though this was conceded to be a fair price, certain members of the Corporation were afraid that the resources of the town were unequal to this burden and the added cost of extending the supply. As an alternative, the Company offered to lease the works to the Corporation for 999 years, at a fixed rental of £275 per annum, with the option to the Corporation of purchasing at any time, on giving six months' notice, for the sum of £6080. One advantage of this scheme was that the cost of obtaining an Act of Parliament at present was avoided; and the Corporation decided to close with the offer. At the last meeting of the Town Council, the Mayor (Mr. A. J. Lawman) stated that Counsel's opinion had been taken on the draft lease, and the Company had met the Water Committee and arrived at an amicable decision as to the points suggested by Counsel. The Committee recommended that the lease be passed and the purchase ratified. Alderman Slee said the Company had not accepted the alterations suggested by Counsel; and he moved, as an amendment, that the lease be not ratified until this was done. The amendment was defeated, and the recommendation of the Committee was adopted with three dissentients. Alderman Slee said he should wash his hands of the whole affair. He believed the water-works would prove a white elephant to the town, and would be its ruin.

Broseley Water Supply.—The Broseley District Council have decided to apply to the Local Government Board for permission to borrow £2750 in order to complete the new water-supply scheme for the town. This, it is stated, means a rate of 4½d. in the pound for thirty years.

The Burnley Corporation Gas, Water, and Electricity Profits.—At the last monthly meeting of the Burnley Town Council, Alderman Greenwood said the members could take it for granted that the profits from the Gas Department for the year would be a little more than £13,000; on the water-works, about £800; and from the electricity supply works, £700. He added that the gas profits would have been larger had it not been for the amount placed to the sinking fund account.

Mr. J. Tomlinson, of Derby, has secured a contract for the laying of mains from Woodville in connection with the Milton water scheme of the Ashby-de-la-Zouch District Council. The amount of his tender was £2278.

On Wednesday, the 30th inst., Mr. R. Mack will offer for sale, at the offices of the Newcastle and Gateshead Gas Company, £20,000 of the Company's preference 5 per cent. stock; being a portion of the money authorized to be raised by the Act obtained last year.

Mr. H. Hallett, who left England last September on a visit to Australia and New Zealand for the benefit of his health, is expected to reach Tilbury in a few days. He returns not only much improved in health, but also brings with him a record of a successful business tour on behalf of the several gas apparatus manufacturers whom he represented at the Antipodes.

By an announcement which appears in our advertisement columns, it will be seen that the Pure Acetylene Gas and Carbide Company, Limited, of Liverpool, which has been incorporated with a capital of £120,000 in 8000 preference and 4000 ordinary shares, of £10 each, are about to issue the former shares, which will bear a cumulative preferential dividend of 6 per cent. per annum.

In the Free Library, Middleton, Messrs. John Wright and Co. recently held an exhibition of gas appliances; Miss Barker giving lectures daily on cookery. During last week, the same firm were exhibiting at Southport and North Walsham; the duty of practically demonstrating the merits of their stoves being confided in the former town to Mrs. Page, and in the latter to Miss Ada Ball.

The Fleetwood Gas Company have had to undertake considerable extensions of their works. An old gasholder tank is being converted into a tar and liquor tank, and a new purifier-house is being built on top of it by a local contractor. The house will contain six 14 feet square purifiers on steel staging, with oxide and lime elevating and conveying apparatus, all covered by an iron roof. The whole of this work is being carried out by Messrs. R. Dempster and Sons, Limited, of Elland, who are also supplying a 20,000 cubic feet station meter and a 14-inch station governor and connections.

What is said to be the largest known deposit of cannel coal in the world is on Bear Creek, in Bell County, Kentucky. The seam is 4 ft. 6 in. thick—solid, pure cannel coal of very high quality, free from all partings or impurities—and extends over a very large area. The Bear Creek Company are now exporting to Europe and South America several thousand tons a month. They recently sold 25,000 tons to one foreign gas company. The Company have purchased the whole of the Log Mountain, in which the deposit occurs—about 30,000 acres—and have built their own railroad, 13 miles long, to the present opening. The largest cargo of any kind of coal that ever left Norfolk (Va.) was recently shipped by this Company, and consisted of 4700 tons of gas cannel, bound for Brazil. Several cargoes have been sent to Liverpool and London.

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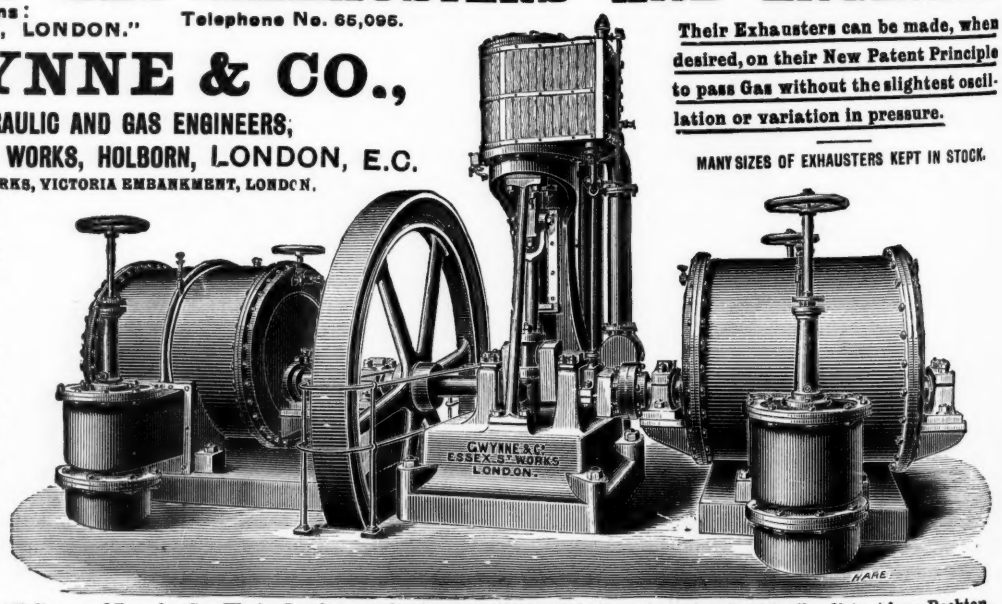

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NOTICE TO ADVERTISERS.

In consequence of the DIAMOND JUBILEE CELEBRATIONS next week, the "JOURNAL" will be published on Monday. Advertisers will therefore kindly advise us as to any alterations required *NOT LATER* than the FIRST POST ON SATURDAY MORNING.

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BROTHERTON AND Co., Ammonia Distillers.
Works: BIRMINGHAM, LEEDS, and WAKEFIELD.

GAS TAR wanted.
BROTHERTON AND Co., Tar Distillers.
Works: BIRMINGHAM, LEEDS, and WAKEFIELD.

SPENT OXIDE wanted.
BROTHERTON AND Co., Chemical Manufacturers.
Works: BIRMINGHAM, LEEDS, and WAKEFIELD.

SULPHURIC ACID for Sale.
BROTHERTON AND Co., Chemical Manufacturers.
Works: BIRMINGHAM, LEEDS, and WAKEFIELD.

BROTHERTON & CO.
Offices: Commercial Buildings, LEEDS.
Correspondence invited.

TUBES for Gas, Steam, and Water (all Sizes), Welded or Riveted. TANKS, HYDRAULIC MAINS, RETORT-LIDS, &c.
JOHN SPENCER, Globe Tube Works, WEDNESBURY; and 14, Great St. Thomas Apostle, LONDON.

HUTCHINSON BROTHERS, Gas Engineers, &c., Falcon Works, Barnsley, Makers of Wet and Dry Gas-Meters, Brass-Work, and general Gas Apparatus, Lead Saturators, Tanks, &c., Tools, and Gas-Works Sundries. (See p. 1321, last week's issue.)
Telegrams: "HUTCHINSON BROS., BARNSLEY."

HYDRATED OXIDE OF IRON.

PREPARED from pure Iron.
Two or three times as rich as Bog Ore.
Strong action on Sulphuretted Hydrogen.
To be used alone, but will increase activity of other Oxides.
Less than half the price of Bog Ore.
Can be lent on hire.
Write for tabulated results.
READ HOLLIDAY AND SONS, LIMITED, HUDDERSFIELD.

WANTED, by a steady, experienced FITTER, a Situation in Gas-Works. Thoroughly experienced in Mains, Services, Slot Meters, Stoves, and General Fitting, Reading Meters, &c. First-Class Testimonials.
Address No. 2864, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

SITUATION wanted as Manager or FOREMAN in small Gas-Works. Understands the working of every process from Retort to the Burner. Competent to do small Repairs on Works, Service laying, and Meter taking. Willing to take Works from 8 Millions down to 2 Millions a year. Good References.
Apply to the MANAGER, Gas-Works, WEST MALLING.

ADVERTISER offers his services for Summer Vacation (Four months). Good Draughtsman, Surveyor, and Accountant. Seven Years' Gas-Works Experience; Three Years' Engineering College. Highest References. Silver Medal "Gas Manufacture." Salary secondary consideration. Age 25.
MOGFORD, Engineering Department, University College, CARDIFF.

ADVERTISER (Son of a Gas Manager) desires a Situation as SECRETARY and MANAGER or MANAGER of Gas or Water Works. Experienced in both. Holds Certificates for Chemistry and Honours Grade Gas Manufacture. First-Class Testimonials and References.
For further Particulars, apply to No. 2857, care of Mr. King, 11, Bolt Court, FLEET STREET E.C.

WORTHING GAS COMPANY.

WANTED, a young Man, thoroughly accustomed to the supervision of Automatic Meters, and capable of taking full charge of them. He must also have a knowledge of Fitting.
Apply, immediately, stating Wages required, with copies of Three Testimonials, to the undersigned.
W. A. WALKER,
Manager.

J. & J. BRADDOCK, Globe Meter Works, Oldham.
First-Class Award, Melbourne Exhibition, 1889, for WET AND DRY GAS-METERS, STATION METERS, AND GOVERNORS, PRESSURE-GAUGES, STREET LAMPS AND PILLARS, &c.
Telegraphic Address: "Braddock Oldham."

SULPHURIC ACID.

JOHN NICHOLSON & SONS, Limited, Chemical Works, Leeds, specially produce this ACID from SULPHUR, for making SULPHATE OF AMMONIA of high quality and *good* colour. Delivery in our own Railway Tank-Wagons or Carboys. Highest references and all particulars supplied on application.

PORTER & CO., Gowts Bridge Works, LINCOLN, Engineers, Ironfounders, and Contractors for the erection of Gas-Works for Towns, Villages, Mansions, Manufactories, Collieries, and Isolated Buildings at home and abroad. Manufacturers of Retorts and Fittings, Condensers, Scrubbers, Purifiers, Valves, &c.; also of Girders, Wrought and Cast Iron Tanks, Iron Roofs, &c.
Telegraphic Address: "PORTER LINCOLN."
[For Illustrated Advertisement, see June 1, p. 1271.]

SADLER & Co., Ld., Middlesbrough; ULVERSTON (BARROW); PORTSMOUTH; CARLTON (N.E.R.); and STOCKTON. Tar and Petroleum Distillers. Benzol and Petroleum Spirit, 700 and other Gravities specially prepared for Carburetting. SOLAR OIL for Gas Making, Kerosene, &c.
Correspondence invited.
Telegraphic Address: "Sadler, Middlesbrough."

NEW GAS PLANT CEMENT.

JOHN E. WILLIAMS AND CO.,
VICTORIA PAINT WORKS,
MANCHESTER.
For all Joints in connection with Oil-Gas Plant and Sulphate Plant.
For all Gas Joints.
For all Tar Joints.
For all Ammonia Joints.

SULPHATE OF AMMONIA SATURATORS.

WALTER THOMASON and SONS, Chemical Plumbers, &c., and Makers of Lead Saturators, &c., 21, WESTON STREET, BOLTON. Repairs of every description.
Please write for Estimate before ordering elsewhere.

ALEX. P. KER, C.E., Consulting Gas Engineer, Hunton Road, Gravelly Hill, Birmingham, 25 Years Assistant Engineer and Manager of Works to the Corporation of Birmingham and their predecessors, MAY BE CONSULTED on all matters connected with GAS ENGINEERING, including Valuations, Alterations, Additions and Extensions, &c. REPORTS upon EXISTING WORKS and IN PROGRESS. EXAMINATIONS OF GAS for ILLUMINATING POWER and IMPURITIES conducted. Plans, Specifications, and Estimates prepared.

WANTED, Retort Setters and Brick layers.
Apply to R. DEMPSTER AND SONS, LIMITED, Elland, YORKS.

WANTED, at once, a leading Stoker, used to Regenerative Firing. Will have charge of Boiler, Engine, and Exhauster. Must be steady and capable. Permanency to good Man.
Apply, for further Particulars, to R. WATSON, Manager, Gas-Works, HERTFORD.

GREAT YARMOUTH GAS COMPANY.

WANTED, a Foreman to take charge of Works at night. One with mechanical knowledge will be preferred. Wages £2 per week.
Apply, stating Age, Experience, and all Particulars, to ENGINEER, Gas Company, GREAT YARMOUTH.

WANTED, by the Bexhill Water and Gas Company, a steady, active Man as METER INSPECTOR and COLLECTOR. Applicants must be of good address, have held similar position, and be competent to inspect and take Indexes of Meter correctly. Wages 26s. per week.
Applications, with Testimonials, to be forwarded to the MANAGER, Gas Office, BEXHILL.

HARTLEPOOL GAS AND WATER COMPANY.

WANTED, a first-class Draughtsman, capable of preparing Plans of Buildings and Structural Ironwork, and the taking out of Quantities. Only those having a thorough knowledge of all the above duties need apply.
Address, stating Age, Experience, and Salary required, THOMAS BOWER, Engineer, Gas and Water Company, WEST HARTLEPOOL.

RUTHIN GAS COMPANY.

WANTED, immediately, a person competent to take down existing Chimney, about 60 feet high, and to build a new one about 50 feet high, *without scaffolding*; the Company finding all Materials and Labour.
The persons applying to state terms per hour for the Work, and to send in applications, with Testimonials as to ability, &c., to the SECRETARY, at Ruthin, by the 21st inst.

GAS PURIFICATION.

OXIDE OF IRON BOG ORE.

BALE & CO.'S Oxide of uniform quality. SPECIAL FIRE CEMENT, OXIDE PAINTS OILS, SULPHURIC ACID, &c.
120 and 121, NEWGATE STREET, LONDON, E.C.
Telegrams: "BOGORE, LONDON."

SULPHATE OF AMMONIA SATURATORS.

JOSEPH TAYLOR & CO., Chemical Plumbers, &c., and Makers of every description of Solid Plate Lead and Timber Cased Saturators, &c. CENTRAL PLUMBING WORKS, TOWN HALL SQUARE, BOLTON. Special Attention to Repairs.
Before placing Orders, please write for Estimate.

PATENTS FOR INVENTIONS.

J. C. CHAPMAN, M.I.M.E. and Fel. Chartered Inst. Patent Agents. ADVICE ON ALL MATTERS CONNECTED WITH ABOVE.
Information and Handbook on application.
70, CHANCERY LANE, LONDON, W.C.

CANNEL, COAL, ETC.

JOHN ROMANS & SON, EDINBURGH, Gas Engineers, supply all the most approved SCOTTISH CANNELS; also FIRE-CLAY GOODS, CAST-IRON PIPES, and other APPARATUS for GAS and WATER WORKS.
Prices, &c., will be forwarded on application to No. 80, ST. ANDREW SQUARE, EDINBURGH, NEWTON GRANGE, NEWBATTLE, DALKEITH, } SCOTLAND.

TO GAS AND WATER OFFICIALS.

SPECIAL and Favourable Terms for CYCLES are offered. The very best "up-to-date" Cycle at a reasonable Cost. "Dunlop" Tyres, Weldless Tube throughout, "Westwood" Rims, "Brook's" Saddle, "Perry's" or "Renold's" Chain, &c. The whole combining to make as fine a Machine as is possible to be made. Satisfaction guaranteed. Send at once for Catalogue post free.
MELROSE CYCLE COMPANY, COVENTRY.

ECONOMY IN PURIFICATION.

INCREASE the Efficiency of your PURIFIERS by adopting CRIPPS'S PATENT BYE-PASS VALVE in the lower Tiers of Sieves. Practical Experience proves their Economy. Engineers are repeating orders after thorough trial.
References and Particulars can be obtained from the Makers—
C. & W. WALKER, Midland Iron-Works, Donnington, near Newport, SALOP.
And J. EVERY & SON, Phœnix Iron-Works, LEWES.

EXPERIENCED Clerk wanted by a Gas Company in a Country Town near London, to keep the Accounts and Books, and do general Secretarial Work. Preference given to one with similar experience.
State Salary required to GAS, care of Solicitors' Law Stationery Society, Limited, 22, CHANCERY LANE, W.C.

COLWALL GAS COMPANY, LIMITED.

WANTED, at once, a Working Manager for small Gas-Works. Make about 2 Millions. Must be a thoroughly steady, practical Man, and good at House Fitting. Wages 25s. per week, with House Coal, and Gas free.
Apply, giving References, to Mr. G. H. T. FOSTER, Solicitor, Secretary to the Company, MALVERN LINK.

SOUTHBANK AND NORMANBY GASLIGHT AND COKE COMPANY, LIMITED.

WANTED, a Competent Man as Fitter, METER INSPECTOR, and REPAIRER, to do Smithing and general Repairs of Works, and to make himself generally useful. Must have a good character for Sobriety and Competency. To a suitable Man, the appointment would be a permanency, and liberal wages given.
Apply, with two recent Testimonials, stating Wages required, to WILLIAM NIXON, Secretary and Manager, Gas-Works, Southbank, R.S.O., YORKS.

GAS CARBON Wanted, not less than 4-Ton Loads.
Apply to the BRIMINGTON CARBON COMPANY, Sowerby Bridge, YORKS.

WANTED—A Gasholder, 25, 30, or 35 feet diameter. Second-hand; but in good order.
Give full Particulars, Price, Age, &c., and where to be seen, to BROWN, BROS., AND Co., LTD., Rosebank Iron-Works, EDINBURGH.

WANTED, to purchase Gas Carbon delivered at nearest Station to Gas-Works, in quantities of not less than 4 tons.
Address, stating Price per ton and quantity, No. 2772, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, to purchase, a set of four PURIFIERS, about 9 feet square by 4 feet deep. Must be in good condition, with necessary Lifting Apparatus, Valves, &c., complete.
Apply to W. A. CLARKE, Selborne Buildings, Millstone Lane, LEICESTER.

OAKHAM GAS COMPANY, LIMITED.

WANTED, one Second-Hand Purifier, either 10 ft. or 12 ft. square, complete with three 8-inch Valves, Wood Grids, and Lifting Gear. All to be in good working condition.

Please state Price and Particulars to

JAS. MASON,
Manager.

Gas Office, Oakham,
June 4, 1897.

FOR SALE—Drawing Instruments. Set complete, in Walnut Case, by best Maker. Nearly new. A Bargain.

Apply to MRS. GRIFFITHS, 29, Rivers Street, BATH.

FOR SALE—A Cast-Iron Annular CONDENSER and SCRUBBER, with 6-inch Pipe Connections and Bye-Pass Valves. Suitable for a make of 4 or 5 Millions. Removed to make room for larger.

Apply to the MANAGER, Gas-Works, ROMSEY.

FOR SALE—A Station Meter of 10,000 cubic feet capacity, by Parkinson, of London. Only used a short time, and is in excellent condition.

For further Particulars, apply to No. 2865, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

FOR SALE—A Station Meter complete, in thorough working order. Recently overhauled and certified correct by Messrs. Braddock. Capacity, 50,000 feet per hour.

Apply to JOHN H. DARBY, Brymbo, near WREXHAM.

WRIGHT-EVANS 100-inch Photo- METER in polished Pine. Quite new, and fitted complete with Apparatus of the finest description. FOR SALE at a low figure. This Instrument is verifiable by the Board of Trade, and is complete in every detail.

Apply to ALEX. WRIGHT AND CO., LTD., Precision Works, WESTMINSTER.

GAS PLANT for Sale—I can always offer NEW and SECOND-HAND GAS APPARATUS, including Retorts and Fittings, Condensers, Exhausters, Scrubbers, Washers, Purifiers, Gasholders, Tanks, Valves, Connections, &c. Also COMPLETE WORKS equal to 7000, 20,000, 60,000 cubic feet per diem. **Inquire and compare Prices and Particulars before ordering elsewhere.**

J. F. BLAKELEY, Gas Engineer, Ravensthorpe, YORKS.

INVESTMENTS IN GAS.

FOR SALE—Parcels of Shares in well- known Provincial Gas Companies: PORTSEA ISLAND, paying 13 per cent.; SOUTHAMPTON, paying 10 per cent.; EXETER, paying 10 per cent.; VENTNOR, paying 7½ per cent.; BRISTOL, 5 per cent. Maximum Stock; DORKING, paying 10 per cent.; BOURNEMOUTH GAS AND WATER; and WINCHESTER GAS AND WATER.

Full Particulars of Messrs. LOVE and COOPER, Stock and Share Brokers, PORTSMOUTH.

THE Knowle and District Gas Company, Limited, near Birmingham, invite TENDERS for the supply of best screened COAL and NUTS for the Year ending June 30, 1898, delivered free to Knowle Station, G.W. Railway.

Tenders are also invited for the purchase of the surplus Tar and Ammoniacal Liquor produced in One Year ending June 30, 1898.

Full Particulars to be obtained of the undersigned.

By order,
FRED J. WARD,
Secretary and Manager.

Knowle Gas-Works,
June 11, 1897.

DARLINGTON GAS-WORKS.

THE Corporation of Darlington are pre- pared to receive TENDERS for the construction of a GASHOLDER TANK, 143 ft. 3 in. diameter, in the vicinity of their present Gas-Works.

Drawings may be inspected and Specifications and Forms of Tender, with Schedules of Quantities, may be obtained, on payment of Two Guineas (returnable if a *bonâ-fide* tender be made), at the Borough Surveyor's Office, Town Hall, Darlington, and at the Office of Messrs. T. & C. Hawksley, Civil Engineers, 30, Great George Street, Westminster, on and after Monday, the 14th inst.

Tenders, endorsed "Tender for Gasholder Tank," and addressed to the Chairman of the Gas-Works Committee, to be delivered at my Office, Houndgate, Darlington, on or before the 6th of July next.

The Corporation do not bind themselves to accept the lowest or any tender.

By order,
F. T. STEAVENSON,
Town Clerk.

Darlington, June 2, 1897.

DARLINGTON GAS-WORKS.

THE Corporation of Darlington are pre- pared to receive TENDERS for the construction of a THREE-LIFT GASHOLDER, 140 feet diameter, in the vicinity of their present Gas-Works.

Drawings may be inspected, and Specifications and Forms of Tender may be obtained, on payment of Two Guineas (returnable if a *bonâ-fide* tender be made), at the Borough Surveyor's Office, Town Hall, Darlington, and at the Office of Messrs. T. & C. Hawksley, Civil Engineers, 30, Great George Street, Westminster, on and after Monday, the 14th inst.

Tenders, endorsed "Tender for Gasholder," and addressed to the Chairman of the Gas-Works Committee, to be delivered at my Offices, Houndgate, Darlington, on or before the 6th of July next.

The Corporation do not bind themselves to accept the lowest or any tender.

By order,
F. T. STEAVENSON,
Town Clerk.

Darlington, June 2, 1897.

CROWBOROUGH GAS-WORKS.

(L.B. & S.C. RAILWAY, 41 MILES FROM LONDON.)

THE Provincial Gas-Works (Crow- borough), Limited, invite TENDERS for EXCAVATING TRENCHES and LAYING from 4 to 4½ miles of CAST-IRON SOCKET PIPES.

Tender to be on Form obtainable at the Company's Office, St. Stephen's Chambers, Telegraph Street, E.C., where Plan and Specification may be *now* seen.

Tenders to be sent in to the Company on or before Three p.m., on Friday, the 25th inst.

R. S. MAYNE,
Secretary.

St. Stephen's Chambers,
Telegraph Street, E.C., June 15, 1897.

LINCOLN CORPORATION.

(GAS DEPARTMENT.)

TENDERS FOR COAL.

THE Gas Committee of the Lincoln Cor- poration invite TENDERS for the supply of 25,000 Tons of screened GAS COAL and NUTS, to be delivered during a period commencing the 1st of July, 1897, and terminating the 30th of June, 1898.

Further Particulars and Forms of Tender may be obtained from the undersigned.

Sealed and endorsed tenders, addressed to the Chairman of the Gas Committee, must be delivered on or before the 26th inst.

The Committee do not bind themselves to accept the lowest or any tender.

JNO. CARTER,
Manager.

Gas Offices, Lincoln,
June 5, 1897.

EAST RETFORD CORPORATION GAS UNDERTAKING.

THE Gas Committee of the above are open to receive TENDERS for the supply of 5000 Tons of best screened GAS COAL or NUTS, delivered free at the Sidings of the G.N. or M.S. & L. Railway Stations as may be required during the Year ending June 30, 1898.

Tenders to be sent in, addressed to the Chairman of the Gas Committee, on or before the 30th inst., endorsed "Tender for Coal."

Any further Particulars may be had from the undersigned.

The lowest or any tender will not necessarily be accepted.

J. B. FENWICK,
Engineer and Manager.

Gas and Water Office, Retford,
June 9, 1897.

EAST RETFORD CORPORATION GAS UNDERTAKING.

TO MANUFACTURING CHEMISTS, &c.

THE Gas Committee of the above are open to receive OFFERS for the purchase of the surplus TAR and AMMONIACAL LIQUOR produced at their Works during the Year ending June 30, 1898.

Tenders, stating price per ton, with scale of Prices for Liquor according to strength as tested by Twaddel's Hydrometer at our Works, to be sent in on or before June 30, addressed to the Chairman of the Gas Committee, and endorsed "Tender for Tar" or "Liquor."

Any further Particulars may be had from the undersigned.

The highest or any tender will not necessarily be accepted.

J. B. FENWICK,
Engineer and Manager.

Gas and Water Office, Retford,
June 9, 1897.

EAST RETFORD CORPORATION WATER UNDERTAKING.

TO ENGINEERS AND ROOF MANUFACTURERS.

THE Water Committee of the above Corporation invite TENDERS for the supply and erection of a CORRUGATED IRON ROOF, with Supports, Framing, Guttering, and Railing complete over their Water-Works Tower Tank.

Plans and Specification may be seen, and further Information obtained, on application to the undersigned.

Tenders to be sent in, addressed to the Chairman of the Water Committee, and endorsed "Tender for Roof," on or before the 30th inst.

The lowest or any tender will not necessarily be accepted.

J. B. FENWICK,
Engineer and Manager.

Gas and Water Offices, Retford,
June 9, 1897.

CITY OF LEEDS.

(GAS DEPARTMENT.)

TENDERS FOR COAL AND CANNEL.

THE Gas Committee of the Leeds City Council are prepared to receive TENDERS for the supply of about 40,000 Tons of CANNEL, and about 180,000 Tons of best GAS COAL (Screened or Nuts). Price per ton to be quoted delivered at the Meadow Lane Gas-Works (Hunslet Lane Siding), New Wortley (Gelderd Junction Siding), or at the Gas-Works, York Street, in such quantities as may be required.

Forms of Tender may be obtained on application to the undersigned.

Tenders may be for any portion of the total quantity required, and will be received not later than Monday, the 28th inst., addressed to the Chairman of the Gas Committee, Municipal Buildings, Calverley Street, and endorsed "Tender for Coal."

The Committee do not bind themselves to accept the lowest or any tender.

R. H. TOWNSLEY,
General Manager.

Municipal Offices, Calverley Street,
Leeds, June 12, 1897.

CHERTSEY GAS CONSUMERS' COMPANY.

THE Directors of the above Company invite TENDERS, by the 28th inst., for One or Two Years' supply of DURHAM GAS COAL. The Quantity to be either 4000 or 8000 Tons.

The Directors do not bind themselves to accept any tender.

Further Particulars of the Manager.

THE East Dereham Urban District Council are prepared to receive TENDERS for the supply of about 1200 Tons of screened GAS COAL for the ensuing Year.

Conditions and Forms of Tender to be had of the undersigned.

Tenders to be sent in by the 5th of July, 1897, to

B. H. VORES,
Clerk to the Urban District Council.

East Dereham.

BOROUGH OF EVESHAM.

(GAS DEPARTMENT.)

TENDERS FOR GAS COAL.

THE Corporation invite Tenders for the supply of from 1000 to 2000 Tons of best screened GAS COAL during the Year ending the 30th of June, 1898, to be delivered on Rail at Evesham.

Tenders to be sent in to me not later than the 28th of June inst.

The Corporation do not bind themselves to accept the lowest or any tender.

THOS. COX,
Town Clerk.

Town Clerk's Office, Evesham,
June 4, 1897.

TYLDESLEY URBAN DISTRICT COUNCIL.

(GAS AND WATER DEPARTMENT.)

THE Committee are desirous of receiving TENDERS for supplying and fixing one 15,000 cubic feet per hour HORIZONTAL ENGINE and ROTARY EXHAUSTER combined on one Bed-Plate.

Full Specification to accompany the tender.

Any further Information may be obtained on application to the Engineer, Mr. J. Timmins, Netherleigh, The Park, Wigan.

Tenders, endorsed "Exhauster," must be delivered to me on or before the 28th inst.

The Committee do not bind themselves to accept the lowest or any tender.

FRANK T. WRIGHT,
Clerk to the Council.

Council Offices, Tyldesley,
June 7, 1897.

CORPORATION OF LANCASTER.

(GAS DEPARTMENT.)

TENDERS FOR GAS COAL.

THE Gas Committee are prepared to receive TENDERS for the supply of screened GAS COAL, delivered on the Gas-Works Siding, Lancaster, in such quantities and at such times as may be required during a period of One Year, commencing delivery Sept. 1 next.

Sealed tenders, endorsed "Gas Coal," giving full Particulars of the Coal offered, must be delivered to T. Cann Hughes, Esq., Town Clerk, Lancaster, on or before the 19th inst.

Forms of Tender may be obtained on application to the undersigned.

The lowest or any tender not necessarily accepted.

C. ARMITAGE.

Gas-Works, Lancaster,
June 1, 1897.

TIPTON GAS-WORKS.

COAL CONTRACTS.

THE Gas Committee of the Tipton Urban District Council are prepared to receive TENDERS for the supply of GAS COAL for a period of One, Two, or Three Years, from the 1st of July next, to be delivered, Carriage free, to the Gas-Works Siding (L. & N.W. Railway).

Specifications and Form of Tender may be obtained at the Gas-Works, on application to Mr. Vincent Hughes, the Engineer and Manager.

Sealed and endorsed tenders to be sent to me the undersigned, not later than Ten a.m., on Saturday, the 26th inst.

The Committee do not bind themselves to accept the lowest or any tender.

By order,
GEO. M. WARING,
Clerk to the Council.

Public Offices, Tipton,
June 5, 1897.

COUNTY BOROUGH OF BRADFORD.

TO COLLIERY PROPRIETORS AND OTHERS.

THE Gas and Electricity Supply Com- mittee of the Bradford Corporation are prepared to receive TENDERS for the supply of best GAS COAL, COBBLES, NUTS, and CANNEL (all to be Well-Screened, Dressed, and free from Shale and Pyrites), to be delivered at the several Works of the Corporation in the Borough during the period of One Year or of Two Years, commencing on the 1st day of August next, as may be agreed upon.

Form of Tender, with any further Information required, may be had on application to Mr. Wood, Gas Engineer, Town Hall.

Sealed tenders, endorsed "Tender for Coal," to be sent to me on or before Thursday, the 1st of July next.

An assurance must be given by each contractor that he will pay to the workmen employed by him not less than the Minimum Standard Rate of Wages.

The Committee do not bind themselves to accept the lowest or any tender.

GEORGE M'GUIRE,
Town Clerk.

Town Hall, Bradford,
June 9, 1897.

The List of Applications Opened at 10 a.m. Monday, the 14th June, and will Close on or before Thursday, the 17th June, 1897, at 3 p.m.

"L'Acetylène est Destiné à Eclairer le Monde."—Raoul Pictet.

THE PURE ACETYLENE GAS & CARBIDE COMPANY, LTD.

Incorporated under the Companies Acts, 1862 to 1893.

CAPITAL - - - - - - £120,000.

Divided into 8000 6 per cent. Cumulative Preference Shares of £10 each £80,000
And 4000 Ordinary Shares of £10 each 40,000

The Preference Shares will confer on the holders rateably the following rights:—

(*a*) The right to a fixed Cumulative Preferential Dividend out of profits at the rate of 6 per cent. per annum on the capital for the time being and from time to time paid up thereon.

(*b*) The right to three-eighths of the surplus profits of each year, or to such proportion of three-eighths as the number of the issued Preference Shares for the time being bears to the whole number of the Preference Shares. In this clause surplus profits mean the profits of each year remaining after paying or providing for the payment of the Fixed Preferential Dividend aforesaid to the close of such year, and after paying or providing for a dividend at the rate of 6 per cent. per annum upon the Ordinary Shares, and also after carrying to reserve a sum not exceeding 5 per cent. of the profits of such year.

(*c*) The right in a winding up to have the assets available for distribution amongst the Members applied first in paying off the capital paid up on the said Preference Shares and any arrears of dividend thereon up to the commencement of the winding up, but without any further right to participate in profits or assets.

The whole of the Ordinary Shares will be allotted to the Vendors in part payment of the purchase-money of the Patents mentioned below.

Issue of 8000 PREFERENCE SHARES of £10 each - £80,000

PAYABLE AS FOLLOWS:—

10s. per Share on application, £1 10s. per share on allotment, and the balance in calls, as required, of not more than £2 each, with an interval of not less than three months between each two calls.

Shareholders will have the option of paying up their Shares in advance of Calls, receiving 4 per cent. Interest upon all sums so paid.

DIRECTORS.

RICHARD AINSCOUGH, Esq. (Messrs. H. and R. Ainscough), Burscoughbridge.
J. S. HARMOOD BANNER, Esq., J.P. (Messrs. Harmood Banner and Son), Liverpool.
JOHN BIBBY, Esq. (Messrs. John Bibby, Sons, and Co.), Garston.
HUGH LYLE SMYTH, Esq., J.P. (Messrs. Ross T. Smyth, and Co.), Liverpool.
J. MARKE WOOD, Esq., Liverpool.
Mons. RAOUL PIERRE PICTET, F.C.S., Paris and Berlin.
Mons. ARMAND ANSPACH-PUISSANT, Avocat, Brussels.

The five-first named Directors are Members of one or both of the Vendor Syndicates; and the two last named Directors are nominated by Mons. PICTET under the terms of the Articles of Association.

BANKERS.

The BANK OF LIVERPOOL, Limited, Liverpool, and its Branches.
Messrs. GLYN, MILLS, CURRIE, and Co., Lombard Street, London.

CONSULTING ENGINEER.

Mons. RAOUL PIERRE PICTET, F.C.S., Paris and Berlin.

SOLICITORS.

Messrs. ALSOP, STEVENS, HARVEY, and CROOKS, Liverpool.

BROKERS.

Messrs. ASHTON, TOD, and NOBLE, Liverpool.

SECRETARY AND OFFICES (pro tem.).

CHARLES E. TALBOT, 19, Castle Street, Liverpool.

PROSPECTUS.

1.—This Company has been formed for the purpose of acquiring and working (1) the Letters Patent (Nos. 18,207 and 18,208 of 1896) granted to the eminent Swiss Chemist, Mons. Raoul Pierre Pictet, of Paris and Berlin, for the United Kingdom, the Channel Islands, and the Isle of Man, for Improvements in the Manufacture and Purification of Acetylene, and in Apparatus therefor; and (2) the Letters Patent (No. 9358 of 1896) granted to Mons. Pictet for the same area, for Improvements in the Process and Apparatus for the Production of Carbide of Calcium, and also the right to apply for a like Patent for further improvements already invented by Mons. Pictet. The Company proposes: (1) To manufacture and supply Carbide of Calcium for home trade and export. (2) To manufacture and supply Pure Acetylene Gas: (*a*) For the supply of Towns, Villages, &c., by mains, precisely as is now done with coal gas. (*b*) For the supply, by special installation, of large Buildings, such as Public Institutions, Manufactories, &c. (*c*) For the supply of Houses, Shops, Offices, &c., by means of portable cylinders containing Acetylene in liquid form. (3) To manufacture and supply Apparatus by which users can produce and supply themselves with pure Acetylene on their own premises. (4) To grant Licences to Municipalities, Gas Companies, and others, either for royalties or fixed payments.

2.—Acetylene Gas is a hydrocarbon, produced in an impure state by a simple process from Carbide of Calcium and Water, and its high Illuminating Power has been long known to the scientific world. Its practical adoption as an illuminant has been hitherto attended by serious disadvantages owing to the impurities that accompany it, which not only reduce its lighting power, but have also the effect of blocking and corroding the metal pipes conveying it.

3.—In the processes protected by the above-mentioned Patents, Mons. Pictet has succeeded in producing, at a very low cost, Chemically Pure Acetylene Gas, which is free from the drawbacks to the Impure Acetylene.

4.—Pictet's Pure Acetylene Gas gives a singularly pure and brilliant light, superior to that of Coal Gas, Water Gas, Oil Gas (even with the best modern Burners) and the Electric Light. Owing to its remarkable brilliancy and penetrating power, it is well adapted for use in the Public Streets, Railway Stations, Manufactories and Workshops, Steam and Sailing Ships, Lighthouses, and Signal Stations. It is also the best illuminant for private Dwelling-Houses, on account of its softness to the eye, and its freedom from gases injurious to health, or to books, pictures, &c. It is equally applicable to the lighting of Railway Carriages, Tramcars, Omnibuses, Carriages, and Bicycles.

5.—As regards cost of production and distribution, Pictet's Pure Acetylene Gas compares no less favourably with all other illuminants. The capital expenditure which would be required to efficiently supply a large city with Pictet's Pure Acetylene Gas would probably not exceed one third of the expenditure necessary for a similar supply of coal gas.

6.—The prime cost of Pictet's Pure Acetylene Gas depends on the cost of Carbide of Calcium, and to secure a supply the Company will acquire Mons. Pictet's new patented process above mentioned for the sole manufacture in the United Kingdom. Mons. Pictet guarantees that the metallic carbides manufactured under the patents (2) or one of them can be produced in England with a minimum electrical horse-power of 2000 at a cost not exceeding £4 sterling per ton, including a fair allowance for establishment expenses and wear and tear of machinery and plant.

7.—Pictet's Pure Acetylene Gas has been tested by the well-known Analytical Chemist, Dr. George Tate, F.C.S., of Liverpool, who has reported (June 4, 1897) upon it as follows:—

"Gentlemen,—I have submitted the Pure Acetylene manufactured by Pictet's process to chemical and photometric tests, and have had for some time past experience in the application of it for purposes of illumination. I find that the illuminating power of the gas per cubic foot per hour is equal to that of 48 to 70 standard candles, its lighting efficiency being, further, but little influenced by comparatively wide variations of pressure.

"Compared with coal gas of good average quality burned from the fish-tail or union jet burners that are most in favour for domestic lighting, I consider one cubic foot of the Pure Acetylene will yield the consumer light equivalent to the average efficiency of at least 30 cubic feet of the ordinary gas.

"Many advantages attend the use of Pure Acetylene as an illuminating gas. The quality of the light that it emits is unequalled in purity and brilliancy by any other artificial illuminant, and approaches in tone to that of the sun; although so brilliant, it is not dazzling to the eye. It is a simple hydrocarbon, and cannot, when purified by Pictet's process, exert any corrosive action upon the pipes used for its conveyance, or occasion blockage during the severest frost. The Burners need entail but a trifling cost, and can be selected so as to give an illumination equivalent to that of from 8 to 60 standard candles, according to the requirements of the consumer. Burned from burners of good construction, the flame is unattended by smoke, gases, or vapours that can damage or corrode books, pictures, or decorative furnishings of a room. The Pure Acetylene has an odour sufficiently strong to permit of the ready detection of an escape; and as such small volumes of this gas are necessary for illumination, there will be, in its application for this purpose, less danger of explosion than there would be in the case of coal gas. It is without any marked poisonous action, whilst for the same light its heating effect upon the atmosphere of a room is far less than that of coal gas; at most only one-tenth of the oxygen of the air is used in its combustion. Hence from a hygienic point of view, Acetylene has much to recommend it. . . . .

"In conclusion, I will express my opinion that Acetylene has a wide field of usefulness before it, not only for lighting, but as a propelling power applied to gas-engines, and also for various manufacturing processes; that it will have an immediate demand, and that it will be practicable to manufacture and supply it by either of the above systems as a cheaper and far more efficient illuminant than coal gas."

8.—The advantages of Pictet's Pure Acetylene Gas over ordinary coal gas may therefore be summed up as follows: (1) Its high illuminating power. (2) The greatly superior quality of the light produced—white, steady, soft to the eyes. (3) Less risk of explosion. (4) Comparative freedom from poisonous action. (5) Less vitiation and heating of the atmosphere. (6) No injurious effects on pictures, books, decorations, &c. (7) Economy in storage and distribution. (8) Its portability and simplicity of adaptation, especially in country places, where there are no mains laid. (9) Its reduced cost.

9.—The Directors have secured the services of Mons. Pictet, as Consulting Engineer to the Company, at an annual salary. Mons. Pictet has also the right, so long as he retains in his own name an agreed amount of the Ordinary Share Capital of the Company, of nominating two Directors on the Board of the Company. The Company will be entitled to the benefit of any further improvements which may be made by Mons. Pictet in the manufacture of Carbide of Calcium and Acetylene Gas.

10.—A suitable site offering favourable conditions is under consideration for the erection of Works. It is estimated that a Works for the manufacture of Carbide and for the generation, purification, and liquefaction of Pictet's Pure Acetylene Gas would cost about £60,000, and would be capable of producing, say, 3000 tons of carbide per annum and 15,000 cylinders of liquid gas per annum, each cylinder containing lighting power equal to 4000 cubic feet of 16-candle power coal gas. Assuming that the production did not exceed two-thirds of the above figures, the Directors estimate the Company's annual profit would be as follows:—

2000 tons carbide, costing £4 per ton, sale price, say, £16 per ton, (considerably less than the present market price)	£24,000
10,000 cylinders liquid Acetylene Gas, costing 7s. 6d. each, sale price, say, 12s. 6d.	2,500
Total estimated profits from the above sources alone	£26,500

or over 20 per cent. upon the total capital of the Company.

In addition, the Company anticipate making substantial Profits from the Granting of Licences to Corporations, Gas Companies, and others, and from the Sale of Gas-making Apparatus.

11.—Companies have been formed for the exploiting of M. Pictet's inventions in various towns on the Continent of Europe, and works on a considerable scale are now in course of erection.

12.—None of the Preference Shares have been underwritten, and no promotion money has been or will be paid.

13.—The Patents have been investigated by Messrs. Sloan and Lloyd Barnes, Patent Agents, Liverpool, and have been submitted to Mr. Fletcher Moulton, Q.C. The cases laid before Mr. Moulton and his opinions, as well as the report of Dr. George Tate, can be inspected at the Offices of the Solicitors of the Company.

14.—The Vendors to the Company are the British Pure Acetylene Gas Syndicate, Limited, and Mr. Charles Edward Talbot, as Agent for the British Carbide Syndicate, who have acquired the Patents from Mons. Pictet, and have fixed the price on the resale to the Company (which resale is at a profit) at £57,000, of which £17,000 is payable in Cash or Preference Shares, at the option of the Company, and the balance (£40,000) in fully-paid Ordinary Shares of the Company.

15.—The following Contracts have been entered into:—

(1) An Indenture, dated the 1st day of March, 1897, and made between Raoul Pierre Pictet of the one part, and the British Pure Acetylene Gas Syndicate, Limited, of the other part.

(2) An Agreement, dated the 1st day of March, 1897, and made between Raoul Pierre Pictet of the one part, and Charles Edward Talbot of the other part.

(3) An Agreement, dated the 10th day of June, 1897, and made between the British Pure Acetylene Gas Syndicate, Limited, of the first part, Charles Edward Talbot of the second part, Raoul Pierre Pictet of the third part, and Robert Pinkerton, on behalf of the Pure Acetylene Gas and Carbide Company, Limited, of the fourth part.

16.—The above-mentioned Contracts and the Memorandum and Articles of Association of the Company can be inspected at the Offices of the Solicitors of the Company.

17.—It is intended to apply to the Liverpool Stock Exchange for a quotation for the Preference Shares.

18.—Applications for Shares must be made to the Bankers of the Company, and accompanied by a Deposit of 10s. per Share. Should no Allotment be made the Deposit will be returned in full; and if a less number of Shares than are applied for be allotted, the balance of the Deposit will be applied towards the payment of the amount due on Allotment, and any surplus will be repaid.

19.—Prospectuses and Forms of Application can be obtained at the Offices of the Company, and from its Bankers, Solicitors, and Brokers.

No. 19, *Castle Street, Liverpool, June* 11, 1897.

OAKHAM GAS COMPANY, LIMITED.

THE Directors of the above Company are prepared to receive TENDERS for the supply of about 900 Tons of best screened GAS COAL.

For Particulars and Forms of Tender, apply to

JAS. MASON,
Manager.

Gas Office, Oakham,
June 4, 1897.

TAR.

THE Directors of the Reading Gas Company invite TENDERS for the purchase of their surplus TAR for One Year, commencing on the 1st of July next.

Specifications for the contract will be forwarded on application.

Rail communication direct to the Works.

Tenders, endorsed "Tender for Tar," must be delivered not later than Monday, the 28th of June, to

ARTHUR H. CANE,
Secretary.

7, King Street, Reading,
June 10, 1897.

TO COAL CONTRACTORS AND OTHERS.

THE Sedgley Urban District Council invite TENDERS for supplying 750 to 1000 Tons of GAS COAL, the deliveries to be made at the Shut End Siding at such times and in such quantities as may be directed.

Sealed tenders, marked "Coal," must reach me on or before the 7th of July next.

The Council do not bind themselves to accept the lowest or any tender.

By order,
JOSEPH SMITH,
Clerk to the Council.

Offices: High Holborn,
Sedgley, June 10, 1897.

TENTERDEN GAS COMPANY.

THE Directors invite Tenders for the supply of 550 Tons of best GAS COAL, delivered at Headcorn or Appledore Stations (S.E. Railway)—400 Tons to be delivered during the months of July, August, and September; and the remainder as and when required.

Tenders, with Analysis and full Particulars of the Coal offered, to be sent to me on or before Friday, the 18th inst.

The lowest or any tender not necessarily accepted.

GEO. F. VARTY,
Secretary.

Tenterden, June 10, 1897.

FENTON URBAN DISTRICT COUNCIL.
(GAS DEPARTMENT.)

THE Gas Committee invite Tenders for the supply and delivery of 3000 to 5000 Tons of good GAS COAL or BURGY.

Forms of Tender and Particulars may be obtained from the Manager.

Tenders to be sent in on or before Saturday, the 19th inst., marked "Tender for Coal," and addressed to the Chairman, Gas-Works, Fenton.

F. H. DARWIN,
Manager.

Gas Offices, Fenton,
June 3, 1897.

THE Corporation of Middleton are prepared to receive TENDERS for a quantity of COAL and CANNEL, to be delivered at the Middleton Railway Station.

Further Particulars and Form of Tender may be obtained from Mr. Duxbury, Gas Manager.

Tenders, addressed to the Chairman of the Gas Committee, to be delivered at my Office on or before Wednesday, the 16th day of June, 1897, endorsed "Tender for Coal or Cannel," as the case may be.

The Corporation do not bind themselves to accept the lowest or any tender.

FREDERICK ENTWISTLE,
Town Clerk.

Town Hall, Middleton,
Near Manchester, June 2, 1897.

NOTICE.

THE Grangemouth Gas Company, Limited, invite TENDERS for erecting a SINGLE-LIFT GASHOLDER, 80 feet diameter by 18 feet deep, prepared for telescoping; also for EXCAVATING and BRICKLAYING of TANK for Holder, 84 feet diameter by 19 feet deep.

Plans may be seen, and Specifications and Forms of Tender got from Mr. Winton, Manager, Gas-Works, on or after Thursday, the 10th of June, on deposit of 10s. 6d., returnable on receipt of *bond-fide* offer.

Offers, marked "Tender for Holder," or "Tender for Tank," to be sent in to the Subscriber not later than the 17th of June.

W. M. ANDERSON,
Solicitor.

Grangemouth.

CORPORATION OF COLNE.
(GAS DEPARTMENT.)

THE Gas Committee invite Tenders for the surplus TAR made at the Gas-Works during the Year ending March 25, 1898.

Estimated quantity, 650 Tons.

Tenders, endorsed "Tender for Tar," to be delivered at the Office of the undersigned, on or before Saturday, the 26th day of June, 1897.

HY. SIMMONDS, C.E.,
Engineer and Manager.

Gas-Works Offices,
Knotts Lane, Colne, Lancs.

BOROUGH OF WARRINGTON.
(GAS DEPARTMENT.)

COAL AND CANNEL.

THE Gas Committee of the above Borough invite TENDERS for the supply of COAL and CANNEL.

Further Particulars and Forms of Tender may be obtained on application to Mr. W. S. Haddock, Engineer to the Works.

Tenders must be sent in not later than the 30th inst.

FREDK. TAYLOR,
Secretary.

Gas Offices, Warrington,
June 12, 1897.

SUTTON, SOUTHCOATES, AND DRYPOOL GAS COMPANY (INCORPORATED), HULL,

INVITE Tenders for the surplus Tar, also for the whole of the AMMONIACAL LIQUOR produced at their Works, at per ton over the Company's Weighing-Machine, from the 1st of July, 1897, to the 30th of June, 1898, both inclusive.

Probable quantity of Tar, 900 Tons.
Do. Ammoniacal Liquor, 1100 Tons.

Both Tar and Ammoniacal Liquor to be taken from the Company's elevated Tank into Contractor's Carts, which must be supplied as required by the Vendors.

Tenders for Ammoniacal Liquor must state price per degree Twaddel's Hydrometer, from 4° to 8°.

Further Particulars may be obtained of the Manager at the Gas-Works, St. Mark's Street.

Tenders to be sent to the undersigned on or before the 28th of June, 1897, endorsed "Tender for Tar or Liquor."

The Company do not bind themselves to accept the highest or any tender.

DAVID WOOD,
Secretary.

Offices: St. Mark's Street, Hull,
June 4, 1897.

ISSUE OF STOCKS AND SHARES BY AUCTION UNDER PARLIAMENTARY POWERS.

MR. ALFRED RICHARDS undertakes the issuing by Auction of GAS AND WATER SHARES under Parliamentary Power.

He also holds MONTHLY SALES of GAS AND WATER SHARES at the Auction Mart, Tokenhouse Yard, E.C.

Terms for the issuing of Capital, and also for offering to auction Gas and Water Shares, and all Particulars relating thereto, may be had of Mr. Alfred Richards.

Offices: 18, FINSBURY CIRCUS, E.C.

By Order of the Directors of the
TOTTENHAM AND EDMONTON GASLIGHT AND COKE COMPANY.

SALE OF DEBENTURE STOCK.

MR. ALFRED RICHARDS will Sell by AUCTION, at the Mart, E.C., on Monday, July 5, at Two o'clock, in lots, £15,000 FOUR PER CENT. PERPETUAL DEBENTURE STOCK of the above Undertaking, offering to Trustees and others an Investment of the soundest character.

Particulars at the COMPANY'S OFFICES, TOTTENHAM; and of the AUCTIONEER, 18, FINSBURY CIRCUS, E.C., and TOTTENHAM.

By Order of the Directors of the
GUILDFORD GASLIGHT AND COKE COMPANY AND OTHER OWNERS.

GAS AND WATER STOCKS AND SHARES.

MR. ALFRED RICHARDS will Sell by AUCTION, at the Mart, E.C., on Tuesday, July 6, at Two o'clock, in lots, STOCKS AND SHARES in the—

Guildford Gaslight and Coke Company.
Portsea Island Gaslight and Coke Company.
Lea Bridge District Gas Company.
Maldon Gas Company.
Ilford Gaslight and Coke Company, Limited.

Particulars of the AUCTIONEER, 18, FINSBURY CIRCUS, E.C.

HORNSEY GAS COMPANY.

NOTICE is Hereby Given, that the TRANSFER BOOKS, so far as they relate to DEBENTURE STOCK only, WILL BE CLOSED on the 23rd inst, and RE-OPENED on the 1st of July.

S. J. WILLIAMS,
Secretary.

68, Chancery Lane, W.C.,
June 14, 1897.

TOTTENHAM AND EDMONTON GASLIGHT AND COKE COMPANY.

SALE BY AUCTION OF £15,000 OF FOUR PER CENT. PERPETUAL DEBENTURE STOCK.

NOTICE is Hereby Given, that it is the intention of the Directors of this Company to SELL BY AUCTION at the Mart, Tokenhouse Yard, London, on the 5th day of July next, £15,000 of £4 PER CENT. PERPETUAL DEBENTURE STOCK, in accordance with the Provisions of the Tottenham and Edmonton Gas Act, 1882.

The Stock must be paid up in full on or before the 31st day of July next, after which date Interest will commence to accrue on such Stock, to be payable by Warrant on the 1st day of January and the 1st day of July in each year.

Particulars and Conditions of Sale may be obtained on application at the Offices of the Company; of Messrs. Merriman, Pike, and Merriman, 21, Austin Friars, E.C., Solicitors; or of Mr. Alfred Richards, Auctioneer, 816, High Road, Tottenham, and 18, Finsbury Circus, London.

By order,
JAMES RANDALL,
Secretary.

Offices: Willoughby Lane,
Tottenham, June 4, 1897.

NEWCASTLE-ON-TYNE AND GATESHEAD GAS COMPANY.

SALE OF FIVE PER CENT. PREFERENCE STOCK.

THE Directors have instructed Mr. ROBERT MACK, Auctioneer, to SELL BY AUCTION, at the Offices of the Company, Grainger Street West, Newcastle-upon-Tyne, on Wednesday, the 30th day of June, 1897, at Twelve o'clock noon precisely, £20,000 of the NEWCASTLE-UPON-TYNE AND GATESHEAD GAS PREFERENCE STOCK, bearing a fixed Preferential Dividend of 5 per cent. per annum, being part of the moneys authorized to be raised by the Newcastle-upon-Tyne and Gateshead Gas Act, 1896.

For Conditions of Sale and further Particulars, apply to the undersigned.

THOS. WADDOM,
Secretary.

Gas Office, Newcastle-upon-Tyne,
June 3, 1897.

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OUT OF THEIR
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Messrs. J. & H. S. PATTINSON, *May 28, 1895.*

Yield of Gas per Ton .	10,500 Cub. Ft.
Illuminating Power .	16·9 Candles.
Coke (of good quality) .	67·5 per Cent.
Sulphur	0·58 ,,
Ash	2·78 ,,

For Price, &c., apply to the
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HOLMSIDE GAS COALS.
PRESENT DAILY PRODUCE OVER 4000 TONS.
LATEST ANALYSIS—By CHARLES PHILLIPS, Gas Examiner to Rotherham Corporation.

Yield of Gas Per Ton. . 11,205 Cubic Feet.
Illuminating Power, 16 1/10 Stand. Sperm. Candl.
Coke (of good & pure quality) 13¾ Cwt. Per Ton.
Sulphur . . . . A little over 1 Per Cent.
Ash . . . . . Under 1 Per Cent.
Tar . . . . . 163 Lbs. (Avoir.) Per Ton.
Ammoniacal Liquor 103 Lbs. (Avoir.) Per Ton.

HOLMSIDE GAS COALS are supplied to the largest Gas Companies in England and on the European Continent; London alone consuming about half the produce.

SOUTH MOOR PELTON GAS COALS.
PRESENT DAILY PRODUCE AVAILABLE 2500 TONS.
RESULTS OF DIFFERENT ANALYSES:—

Yield of Gas Per Ton. . 10,500 Cubic Feet.
Illuminating Power . 17 Stand. Sperm Candl.
Coke (of excellent quality) . 13½ Cwt. Per Ton.
Sulphur . . . . . 1·13 Per Cent.
Ash. . . . . 1·34 Per Cent.
Tar. . . . . 180 Lbs. (Avoir.) Per Ton.
Ammoniacal Liquor 94½ Lbs. (Avoir.) Per Ton.

The HOLMSIDE and SOUTH MOOR COALFIELD possesses *a very great quantity of the best Coal;* and, whilst other Coal-Fields are becoming exhausted, this one is only being opened out, so that *the quality* of both the HOLMSIDE COALS, and the SOUTH MOOR COALS *may be relied upon for all practical purposes.*

These Coals may be bought through the Principal Merchants in England, or direct from
MR. MARK ARCHER,
HOLMSIDE AND SOUTH MOOR OFFICES,
NEWCASTLE-UPON-TYNE.

HEBBURN MAIN GAS COALS.

Yield of Gas per ton	10,500 cub. ft.
Illuminating Power	16·4 candles.
Coke	68 per cent.

For Prices, f.o.b. Ship or Delivered by Rail, apply to
THE WALLSEND & HEBBURN COAL COMPANY, LTD.
B Lombard Street,
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W. RICHARDSON, Fitter.

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Worked by THE HARTON COAL CO., LTD.
Output about 3000 tons per day.

ANALYSIS—

Yield of Gas per ton .	10,500	Cubic Feet.
Illuminating Power . .	16·9	Candles.
Coke	66·7	Coke.
Sulphur	0·86	Sulphur.
Ash	2·04	Ash.

Boldon Gas Coals are supplied under contract to
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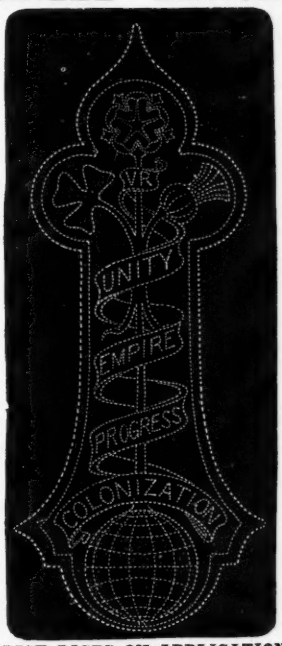

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Yield of Gas per ton	13,155 cub. ft.
Illuminating Power	38·22 candles.
Coke per ton	1,301·88 lbs.

EAST PONTOP GAS COAL.

Yield of Gas per ton	10,500 cub. ft.
Illuminating Power	17·8 candles.
Coke	70 per cent.

SOUTH PELAW MAIN GAS COAL.

Yield of Gas per ton	10,500 cub. ft.
Illuminating Power	16·3 candles.
Coke	73·1 per cent.

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21, JOHN STREET, ADELPHI, LONDON, W.C.

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Note.—Makers of HORSLEY'S PATENT SYPHONS. These are cast in one piece, without Chaplets; doing away with bolts, nuts and covers and rendering leakage impossible.

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OUGHTIBRIDGE, near SHEFFIELD,
MANUFACTURE
SILICA BLOCKS,
BRICKS, AND CEMENT
OF SUPERIOR QUALITY
FOR GAS-FURNACES.
Trade Mark: "SILICA."

These Goods (largely used in Gas, Glass, Iron, and Steel Works) are, on account of their
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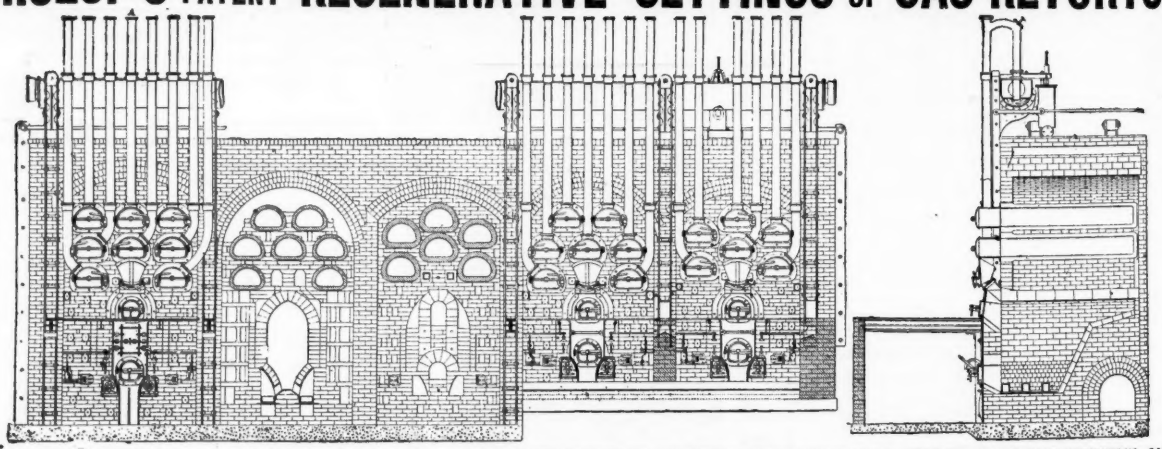
HISLOP'S PATENT REGENERATIVE SETTINGS OF GAS-RETORTS.



THESE SETTINGS ARE POSITIVELY UNRIVALLED IN PRODUCTIVE CAPACITY, DURABILITY, AND SIMPLICITY OF MANAGEMENT. RETORTS OF ORDINARY DIMENSIONS CARBONIZING FROM 17 TO 20 CWT. OF ENGLISH AND 20 TO 24 CWT. OF SCOTCH COAL PER 24 HOURS, DEPENDING UPON THE NATURE OF THE COAL, AND PRODUCING UP TO FULLY 13,000 CUBIC FEET PER MOUTHPIECE IN THE SAME TIME, AND WITH THE SMALLEST EXPENDITURE OF FUEL ATTAINABLE, AND RETURNING IN PROFIT THE ENTIRE COST OF ERECTION WITHIN TWELVE TO EIGHTEEN MONTHS; AND THUS REDUCING TO INSIGNIFICANCE THE INCREASED COST OF THESE SETTINGS OVER THE COMMON OR GENERATOR FURNACE SYSTEMS.

THESE SETTINGS ARE EXTENSIVELY ADOPTED, AND ARE ERECTED UPON THE SHALLOW AND STAGE FLOOR PLANS. THEY ARE ADAPTED TO ANY EXISTING ARRANGEMENTS, AND PERFECT SATISFACTION GUARANTEED. THE COMPOSITION OF FIRE-RESISTING AND OTHER SPECIAL FIRE-CLAY MATERIALS FURNISHED IS OF THE HIGHEST ORDER; AND THE SYSTEM AS A WHOLE, AS NOW PERFECTED, IS THE RESULT OF LONG EXPERIENCE AND CAREFUL STUDY OF THE PRINCIPLES OF GASEOUS FIRING.

Drawings and Tenders are furnished for the complete erection of Benches, including Retort and Bench Mounting of the most modern and approved description; or existing Ovens fitted up with the Patentee's arrangements.

Agents: **Messrs. JONAS DRAKE AND SON**, Retort Setters and General Carbonizing Engineers, Ovenden, Halifax, Yorkshire, Sole Agents for England, Wales, and Foreign Countries; **C. M. HAMILTON**, Retort Setter and Contractor, Hamilton, Agent for Scotland and Ireland; Principal Agent, **R. F. HISLOP** (Son of Patentee), General Constructing and Carbonizing Engineer, Gas-Works, Paisley, N.B., and to whom all Inquiries should be addressed in the first instance.

HISLOP'S PATENT HYDRAULIC MAIN SEAL-REGULATING AND TAR-EXTRACTING VALVE is a *Sine qua non* TO THE SATISFACTORY WORKING OF THE HYDRAULIC MAIN UNDER THE REGENERATIVE AS WELL AS OTHER SYSTEMS OF RETORTS. BEING LARGELY ADOPTED AND AFFORDING THE HIGHEST SATISFACTION.
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IN CONSEQUENCE OF MISREPRESENTATIONS WHICH HAVE BEEN CIRCULATED RESPECTING THE SUNLIGHT MANTLES, THE FOLLOWING CERTIFICATE IS NOW GIVEN WITH EVERY MANTLE:—

"*The New Incandescent (Sunlight Patent) Gas Lighting Company, Limited, hereby certify that thewithin Mantle is in every respect similar in process of Manufacture and constituent parts or substances to the Mantle which was held by the Hon. Mr. Justice Wills* NOT TO BE AN INFRINGEMENT OF THE WELSBACH PATENTS."

AND WE FURTHER CALL ATTENTION TO THE EXTRACTS FROM THE JUDGMENT GIVEN BY THE HON. MR. JUSTICE WILLS, WHEN HE DISMISSED THE WELSBACH COMPANY'S APPLICATION FOR INJUNCTION:—

"No use is made by the Sunlight Company of any of the rare earths; and their choice of substances, and their method of applying the illuminants, appear to me to be **as wide asunder as the Poles** from those contemplated by Welsbach."

"Welsbach Company's Counsel, both admit that they have no case unless the Welsbach skeleton, of whatever resistant earth oxides composed, is within the Welsbach Patent. It seems to me that **this is just what Welsbach did not claim.**"

PRICE LIST AND TERMS ON APPLICATION.

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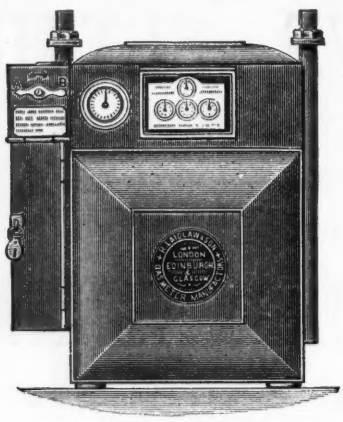
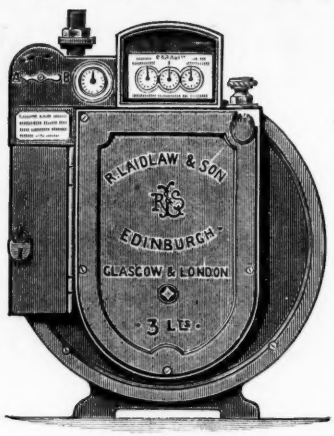
SIEMENS WATER-METERS,

PREPAYMENT GAS-METERS.



—DRY METER.—



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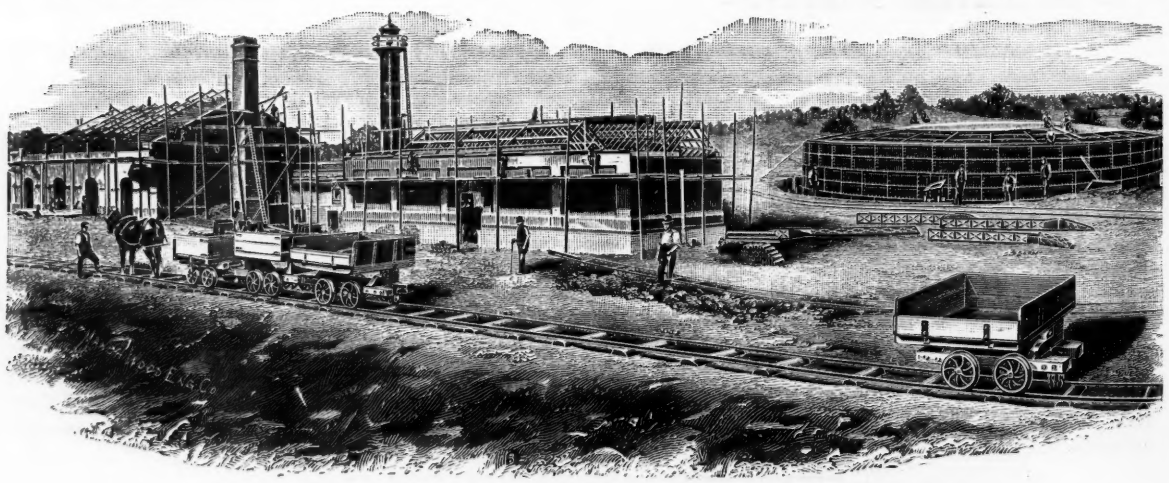

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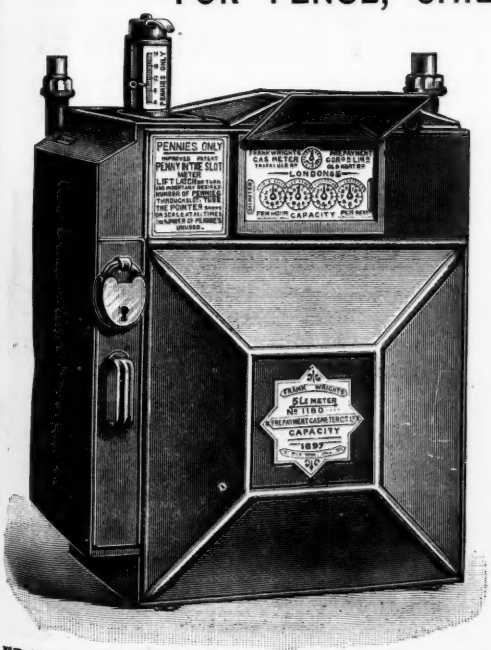

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[See Illustrated Advertisement, June 1, p. 1267.]

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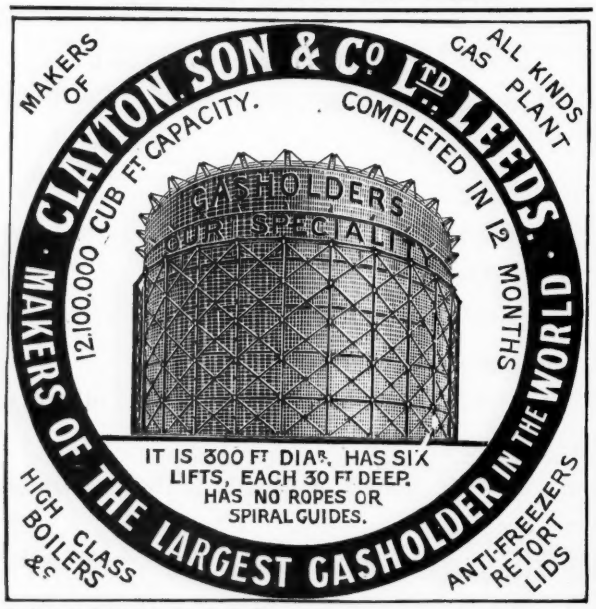
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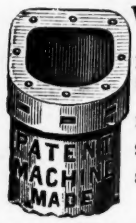

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Near LEEDS,
Have confidence in drawing the special attention of GAS ENGINEERS to the following advantages of their Retorts:—
1. Smooth interior, preventing adhesion of Carbon.
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Fire-Bricks, Lumps, Tiles, &c., &c., of every description suitable for Gas-Works.

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Sulphate of Ammonia Apparatus.

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In Lennard's Apparatus, there is a constant supply of Tar to the Plant, and a constant flow of Oils and Pitch from the Plant, producing the following Advantages :—

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[See also Advt. p. 1340.

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